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Spatial correlations in catch rates, annual landings, and lobster sizes among port clusters in the LFA 33 lobster fishery

Corrélations spatiales dans les taux de capture, les débarquements annuels et les tailles de homard entre des regroupements de ports dans la pêche

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Abstract

Correlations among port clusters and groups of port clusters were used to determine associations among the lobster fisheries in Lobster Fishing Area (LFA) 33. Correlations among fall and spring landings indicate an association among port clusters 2-5 and 8-13. Port cluster 1 does not have strong associations with any other port cluster. Port clusters 6 and 7 appear to be an intermediate group.

Port clusters were grouped for catch rate analysis into port clusters 1-4, 5-9, and 10-13. Fall catch rates significantly increased from 1994 to 1999 in all groups of port clusters. Spring catch rates exhibited significant annual differences only for the analysis that combined port clusters 5 - 9. Correlations among fall catch rates indicate that catch rates were positively and significantly correlated only between port clusters 5-9 and 10-13 and port clusters 5-9 and 1-4. Only port clusters 5-9 and 10-13 were significantly correlated for spring catch rates.

Length frequencies examined from port sampling indicated that in general males and females caught in the spring were larger than those caught in the fall. However, there were in general no significant correlations among port clusters with respect to changes in length.

These results are consistent with the findings of previous analyses that have shown that there are fishery differences between the western and eastern portions of LFA 33. It would seem appropriate to undertake an analysis of the consequences of splitting LFA 33 into two groups that would lead to more homogenous areas for fisheries management.

Résumé

Des corrélations entre des regroupements de ports et des groupes de regroupements de ports ont servi à déterminer des associations entre les pêches du homard dans la zone de pêche du homard (ZPH) 33. Des corrélations entre les débarquements à l'automne et au printemps révèlent une association entre les regroupements de ports 2-5 et 8-13. Il n'y a pas de forte association entre le regroupement de ports 1 et aucun autre des regroupements. Les regroupements de ports 6 et 7 semblent constituer un groupe intermédiaire.

Aux fins de l'analyse des taux de capture, on a constitué des groupes formés respectivement des regroupements de ports 1-4, 5-9 et 10-13. Les taux de capture en automne ont augmenté de façon notable de 1994 à 1999 dans tous les groupes. Ils étaient corrélés de façon positive et significative uniquement entre les regroupements de ports 5-9 et 10-13 et les regroupements de ports 5-9 et 1-4. Les taux de capture au printemps ont présenté des différences annuelles significatives uniquement dans le groupe combinant aux fins de l'analyse les regroupements de ports 5-9. Ils étaient corrélés de façon significative uniquement entre les regroupements de ports 5-9 et 10-13.

L'étude de la distribution des longueurs à partir des échantillons prélevés dans les ports a révélé qu'en général, les mâles et les femelles capturés au printemps étaient plus gros que ceux pris à l'automne. Cependant, il n'y avait généralement pas de corrélation significative entre les regroupements de ports en regard des changements dans la longueur.

Ces résultats concordent avec les conclusions d'analyses antérieures qui ont révélé des différences dans la pêche entre les parties occidentale et orientale de la ZPH 33. Il semblerait justifié d'entreprendre une analyse des conséquences de la division de la ZPH 33 en deux groupes afin d'obtenir des zones de pêche plus homogènes pour la gestion de la pêche.

Introduction

LFA 33 extends from Halifax to Port La Tour (Fig. 1). The fishing season extends from the last Monday in November to May 31. LFA 33 is divided into 13 port clusters (Figs. 1, 2, 3, Appendix 1) and a uniform management plan currently applies to the LFA. The purpose of this paper is to investigate associations among the port clusters with respect to catch rate, annual landings, and length frequencies to determine if fishery differences occur in this LFA that should be examined with respect to their effects on fisheries management. Differences in these characteristics among port clusters, particularly if they coincide with other life history differences, would support an investigation into the consequences that non-uniform management regimes might have in meeting conservation targets in these fisheries. In the broader context of managing and defining lobster production areas (LPAs), knowledge on variation in the population and fishery characteristics by groups of ports will be necessary.

Fishery Description

Regulations

The season for LFA 33 is the last Monday in November (November 27 in 2000) to May 31. The minimum carapace length for the fishery in 2000 was 82.5 mm. Unless otherwise indicated the fall portion of the season refers to the last Monday in November to the last day in February. The spring portion of the season refers to March 1 to May 31.

Regulations since the beginning of the four year plan in 1998.

Season	Trap Limit	Minimum Size	Season
1998 - 1999	250	81 mm	November 29 - May 31
Fall 1999	250	81 mm	November 28 -
Spring 1999	250	82.5 mm	May 31
1999 - 2000	250	82.5 mm	November 27 - May 31

Industry reviews

Meetings to review the data presented in this report with industry were held in October 2000 and February 2001. The October meetings were to review the history of the fishery and to get general comments on the data to be used in this assessment. The February meetings were to present analyses completed to date and to receive suggestions that could improve these analyses.

General comments from industry that apply to all areas in LFA 33 were that the fishing grounds have expanded in all areas to deeper water. This expansion has been less pronounced in the most eastern portion of LFA 33 compared to the western portion because there is more deep-water habitat in the west as compared to the east. Comments by fishers working in these deeper waters were that in the first years of fishing, catches consisted primarily of large lobsters. In subsequent years, smaller lobsters have predominated in the catches. The explanation given by the fishers for this effect is that more room is created for smaller lobsters as the larger ones are removed. In general industry comments were that landings have been stable and that lobster are more abundant now than in the past. Some comments were made that it is necessary to fish a bit harder and cover more ground to maintain recent catch levels. The specifics of major points from these meetings are in Appendix 2.

Methods

Annual landings

Trends in annual landings have been used to define hypotheses regarding lobster production areas (Campbell and Mohn 1983; Hudon 1994). A correlations analysis among the port clusters investigated whether recent landings (1989 to 2000) provide similar area associations to those determined using historical landings (1892 to 1981) investigated by Campbell and Mohn (1983) and landings from 1947 to 1991 investigated by Hudon (1994). Correlations, r-squared values from paired combinations of port clusters, for fall and spring landings were examined using the corrcoef Matlab function to answer this question.

Data for this examination came from DFO landings statistics in the ZIF (Zonal Interchange Format) data base from the 1989 - 1990 season to the 1999 - 2000 season. From 1989 to 1995 landings data were obtained from sales slips. A survey of fishers in 1993 to1994 (Nolan 1995, unpublished DFO report) indicated that this method underestimated landings by 29% in LFA 33, with the highest incidence of underestimation from port clusters 1 and 2. Beginning in the 1995-1996 season (DFO 1996) landings data were obtained from mandatory monthly logs submitted by lobster fishers. Landings by port were combined to obtain landings by port cluster. The underestimation of landings was recognized by the industry during workshops but it was agreed upon that these would still be useful for identifying relative trends in annual landings.

Catch rates (CPUE)

Differences in CPUE are often used to provide an index of annual changes in population abundance or production (Hilborn and Walters 1992). CPUE in these analyses were defined as numbers caught per trap haul, kilograms caught per trap haul, or tonnes per boat. Consistent annual differences in the CPUE among port cluster would indicate there might be potential

production or abundance differences within the LFA that would require different management measures to achieve conservation objectives. Similarly, differing annual trends in CPUE among the port clusters would indicate that uniform management measures are not having the same affect in all areas.

Annual differences in CPUE were examined by comparing landings per boat among the port clusters. Data for this examination came from DFO landings statistics in the ZIF (Zonal Interchange Format) data base as described above. Unique CFV (Commercial Fishing Vessel) numbers were used to obtain the number of boats fishing in each port cluster. Landings by boat were obtained for the spring and fall portions of each fishing season. Annual trends were not examined using these data because there was no information on weekly or daily landings using the sales slip system. Sales slips may represent lobsters caught over unknown time periods. Similarly, with respect to the mandatory logbooks, fishers will often hold lobsters while waiting for desirable market conditions and so the time period associated with each entry is uncertain (Appendix 2). Timing information is necessary to separate within season effects from annual effects in evaluating annual trends in CPUE.

A data set that permits annual changes in CPUE to be examined comes from logbooks maintained by volunteer lobster fishers in LFA 33 since 1984. The information in the logbooks consists of number of traps fished and either pounds or numbers of lobsters caught each fishing day. The program began in port clusters 5-9. Overall the number of participants has increased, however, fishers participating have also changed over the years. Because there were only a few participants from each port cluster, port clusters were grouped for analysis. The groupings were port clusters 1-4, 5-9, and 10-13. Industry felt these logbooks were a better representation of CPUE in the various fisheries than those resulting from sales slips or the mandatory logbooks (Appendix 2).

To identify changes in CPUE resulting from individual fisher, within season (week), and annual effects a multiplicative analysis (Hilborn and Walters 1992) was performed separately on each of the three sets of port clusters (1-4, 5-9, and 10-13) for spring and fall portions of the season. The analysis was used to derive annual indices of CPUE for each of the groups of port clusters. Tests of significance of the model are base on log transformed data. Results are reported on the natural log scale.

Length frequencies

Trends in size among port clusters would also define hypotheses about the population and fishery interactions of LFA 33. For example, declining mean length may result from increased recruitment or high exploitation. If all port clusters had similar trends for mean length then this would imply that either recruitment or exploitation trends were similar among all port clusters.

Carapace length frequencies have been collected from port samples since 1984, but some samples from port cluster 9 were collected in 1946 and 1949 (Appendix 3). Weighted mean carapace lengths by the fall and spring portions of the season were calculated using the numbers sampled at each length as:

$$\text{Mean Carapace Length} = \frac{\sum n \, x \, \text{length}}{\text{Total Number}}$$

where n is the number at length.

Correlation coefficients between pairs of port clusters were examined using the corrcoef Matlab function.

Results

Annual landings

On average, approximately 725 boats fished in LFA 33 from 1996 – 1999 (Table 1). Port Clusters 3, 4, 9, 10, and 11 accounted for most of the fall effort (Table 1). The number of boats participating in the spring fishery is less than the fall and has typically been about 600. As they did in the fall. port Clusters 3, 4, 9, 10, and 11 accounted for most of the spring effort (Table 2). An anomaly in effort is apparent for the 1998-1999 spring portion of the season (Table 2). Recorded effort was much lower than other years. There is no explanation for this anomaly and landing analyses include this anomalous year with the assumption that the anomaly was equal among all port clusters (Table 3). If this assumption were true then it would not affect the relative relationships among the port clusters.

Average landings per boat for seasons beginning in 1989 to 1999 were higher in the fall than the spring (Table 4). In addition, landings per boat in the fall from port clusters 1-6 were appreciably smaller than those from port clusters 7-13 (Table 4). A similar split was observed during the spring but it was not quite as dramatic (Table 4). Most of the landings are from port clusters 7 to 13 (Table 5).

Significant correlations among port clusters 2-5 were found for fall landings (Table 6, Fig. 5). Port cluster 8 was significantly correlated with landings from port clusters 9-13 (Table 6, Fig. 5). Port cluster 1 was not significantly correlated with any other port cluster (Table 6, Fig. 5).

For spring landings, there were more significant correlations among the block of port clusters from 7-13 than from 1-6. For port clusters 1-6, the significant correlations tended to be between neighboring port clusters rather than in blocks (Table 7, Fig. 6).

Correlations between fall and the following spring catches were significant only between port clusters 6 and 7 (Fig. 7).

These results indicate an association among port clusters 2-5 and 8-13. Port cluster 1 seems to be different than most other port clusters and port clusters 6 and 7 are intermediate.

Catch rates (CPUE)

CPUE differed significantly among fisher, week, and year for each set of port clusters for the fall season analysis ($p<0.001$) (Table 8). These analyses

indicate that fall CPUE has increased significantly between 1994 and 1999 for each set of port clusters (Figs. 8). Port clusters 5-9 CPUE was significantly correlated with port clusters 1-4 and 10-13 ($p<0.05$). However, port clusters 10-13 and 1-4 were not significantly correlated (Fig. 9).

For spring CPUE, fisher and week effects were significant ($p<0.001$) but annual effects were only significant for port clusters 5-9 (Table 9). For port clusters 5-9, CPUE was significantly greater from 1997 to 1999 than from 1993 to 1996 (Fig. 10). CPUE for port clusters 5-9 and port clusters 10-13 were significantly correlated ($p<0.05$) but other port cluster combinations were not significantly correlated (Fig. 11).

Length frequencies

Fall and spring port length frequency samples are summarized in Appendix 3 in both metric and English units. In general, males and females caught in the spring were larger than those caught in the fall (Figs. 12-15). The longest time series was from port clusters 9 and 13. In port clusters 9 and 13 there has been little change in average length of males and females caught in the fall (Figs. 14, 15). Mean length of males and females caught in the spring are somewhat larger in recent years compared with the late 1980s (Figs. 14, 15). However, mean length correlations among the port clusters were not significant.

Discussion

Previous analyses of the relationship among LFA 33 fisheries (Campbell and Mohn 1983; Campbell 1989; Hudon, 1994; and Miller 1997) also found differences between the western and eastern portions of LFA 33. In the case of Campbell and Mohn these were based on a principle components and cluster analysis of landings from 1892 to1981. Hudon (1994) found a split between statistical districts corresponding to port clusters 1-7 versus 8-13 using historical landings between 1947 and 1991. Campbell (1989) examined the recapture sites of lobsters tagged off McNutt Island near Shelburne (port cluster 11). All recapture sites were in the western portion of LFA 33 or the Gulf of Maine including offshore Georges and Browns Bank. None were recaptured in the eastern portion of LFA 33. Miller (1997) found that post larval abundance was greater in the western compared to the eastern portion of LFA 33, while ovigerous females had higher catch rates in the east compared to the west.

These analyses and others indicate fishery and biological differences between the eastern and western portions of LFA 33. The exact position of the east - west split depends on the characteristic examined. It would seem appropriate to undertake an analysis of the consequences of splitting the LFA into two groups that would lead to more homogenous areas for fisheries management. There appears to be a clear split between port clusters 1- 5 and 8-13. Port clusters 6 and 7 appear to be intermediate. Catch per boat seems to divide quite distinctly between port clusters 6 and 7. Initial investigations should examine the biological and management consequences of a split in LFA 33 into

two portions consisting of port clusters 1-5 and 6-13, 1-6 and 7-13, or 1-7 and 8-13.

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Table 1. Number and percentage of boats in the fall as determined by unique inshore CFV numbers in each port cluster from 1996-1999. The fall portion of the season occurs in both calendar years during the season years indicated in the table. For example, 9697 means that the season started on the last Monday in November 1996 and ended May 31, 1997. The fall portion extends only from the starting November date 1996 to the end of February 1997.

Number of boats

	Season years				
Port Cluster	9697	9798	9899	9900	Mean
1	11	11	12	10	11
2	45	39	40	37	40
3	77	73	71	73	74
4	92	81	86	81	85
5	30	33	34	32	32
6	44	48	49	47	47
7	64	62	65	58	62
8	47	43	48	47	46
9	67	62	58	58	61
10	104	98	105	94	100
11	74	74	79	79	77
12	37	37	35	39	37
13	55	54	55	50	54
Sum	747	715	737	705	726

Percentage of boats

	Season years				
Port Cluster	9697	9798	9899	9900	Mean
1	1.47	1.54	1.63	1.42	1.52
2	6.02	5.45	5.43	5.25	5.54
3	10.31	10.21	9.63	10.35	10.12
4	12.32	11.33	11.67	11.49	11.71
5	4.02	4.62	4.61	4.54	4.44
6	5.89	6.71	6.65	6.67	6.47
7	8.57	8.67	8.82	8.23	8.57
8	6.29	6.01	6.51	6.67	6.37
9	8.97	8.67	7.87	8.23	8.44
10	13.92	13.71	14.25	13.33	13.81
11	9.91	10.35	10.72	11.21	10.54
12	4.95	5.17	4.75	5.53	5.10
13	7.36	7.55	7.46	7.09	7.37
Total	100.00	100.00	100.00	100.00	100.00

Table 2. Number and percentage of boats in the spring as determined by unique inshore CFV numbers in each port cluster from 1996-1999. The spring portion of the season occurs in only one calendar year during the season years indicated in the table. For example, 9697 means that the season started on the last Monday in November 1996 and ended May 31, 1997. The spring portion extends only March 1, 1996 to May 31, 1997.

Number of boats

	Spring portion of the season				
Port Cluster	9697	9798	9899	9900	Mean
1	9	9	4	5	7
2	32	32	14	28	27
3	57	66	25	69	54
4	63	66	25	72	57
5	26	29	5	25	21
6	35	39	12	44	33
7	50	56	35	56	49
8	38	38	18	35	32
9	62	56	66	60	61
10	98	97	86	85	92
11	56	56	47	66	56
12	31	34	46	32	36
13	50	53	26	53	46
Total	607	631	409	630	569

Percentage of boats

	Spring portion of the season				
Port Cluster	9697	9798	9899	9900	Mean
1	1.48	1.43	0.98	0.79	1.19
2	5.27	5.07	3.42	4.44	4.66
3	9.39	10.46	6.11	10.95	9.53
4	10.38	10.46	6.11	11.43	9.93
5	4.28	4.60	1.22	3.97	3.73
6	5.77	6.18	2.93	6.98	5.71
7	8.24	8.87	8.56	8.89	8.65
8	6.26	6.02	4.40	5.56	5.67
9	10.21	8.87	16.14	9.52	10.72
10	16.14	15.37	21.03	13.49	16.07
11	9.23	8.87	11.49	10.48	9.88
12	5.11	5.39	11.25	5.08	6.28
13	8.24	8.40	6.36	8.41	7.99
Total	100.00	100.00	100.00	100.00	100.00

Table 3. Landings (tonnes) for Port Clusters in LFA 33.

Port Cluster 1

Season	Fall	Spring	Total	Percent Fall
8990	13.3	2.0	15.3	86.9
9091	17.7	4.0	21.7	81.6
9192	20.5	3.0	23.5	87.2
9293	10.7	4.1	14.8	72.3
9394	6.1	15.1	21.2	28.8
9495	18.3	17.7	36.0	50.8
9596	7.4	3.1	10.5	70.5
9697	12.9	4.1	17.0	75.9
9798	13.4	7.3	20.7	64.7
9899	19.6	8.2	27.8	70.5
9900	23.4	6.4	29.8	78.5
Means	14.8	6.8	21.7	69.8

Port Cluster 2

Season	Fall	Spring	Total	Percent Fall
8990	29.8	9.2	39.0	76.4
9091	45.2	14.9	60.1	75.2
9192	40.8	10.5	51.3	79.5
9293	21.2	9.5	30.7	69.1
9394	28.7	36.9	65.6	43.8
9495	26.6	21.5	48.1	55.3
9596	40.0	10.2	50.2	79.7
9697	43.3	8.4	51.7	83.8
9798	44.2	18.6	62.8	70.4
9899	53.0	24.0	77.0	68.8
9900	55.1	23.7	78.8	69.9
Means	38.9	17.0	55.9	70.2

Port Cluster 3

Season	Fall	Spring	Total	Percent Fall
8990	69.6	30.8	100.4	69.3
9091	83.1	53.5	136.6	60.8
9192	70.4	34.5	104.9	67.1
9293	59.0	41.9	100.9	58.5
9394	84.6	48.4	133.0	63.6
9495	88.8	30.2	119.0	74.6
9596	92.9	23.7	116.6	79.7
9697	93.3	15.0	108.3	86.1
9798	107.0	43.5	150.5	71.1
9899	112.7	62.8	175.5	64.2
9900	144.3	56.4	200.7	71.9
Means	91.4	40.1	131.5	69.7

Table 3. (cont).

Port Cluster 4

Season	Fall	Spring	Total	Percent Fall
8990	75.6	41.5	117.1	64.6
9091	68.4	51.2	119.6	57.2
9192	74.8	31.8	106.6	70.2
9293	57.3	31.3	88.6	64.7
9394	66.7	36.8	103.5	64.4
9495	76.8	7.8	84.6	90.8
9596	104.1	38.0	142.1	73.3
9697	148.7	34.0	182.7	81.4
9798	151.5	74.2	225.7	67.1
9899	161.1	73.9	235.0	68.6
9900	168.4	56.6	225.0	74.8
Means	104.9	43.4	148.2	70.6

Port Cluster 5

Season	Fall	Spring	Total	Percent Fall
8990	24.2	27.9	52.1	46.4
9091	36.8	22.4	59.2	62.2
9192	23.1	10.1	33.2	69.6
9293	21.0	13.0	34.0	61.8
9394	34.3	11.2	45.5	75.4
9495	22.3	16.5	38.8	57.5
9596	25.9	15.7	41.6	62.3
9697	34.6	16.7	51.3	67.4
9798	37.1	30.3	67.4	55.0
9899	42.1	28.7	70.8	59.5
9900	45.6	16.6	62.2	73.3
Means	31.5	19.0	50.6	62.8

Port Cluster 6

Season	Fall	Spring	Total	Percent Fall
8990	41.6	15.7	57.3	72.6
9091	54.5	20.8	75.3	72.4
9192	31.9	7.0	38.9	82.0
9293	23.9	10.5	34.4	69.5
9394	27.6	12.2	39.8	69.3
9495	30.0	13.0	43.0	69.8
9596	45.0	13.0	58.0	77.6
9697	59.5	11.3	70.8	84.0
9798	71.2	30.6	101.8	69.9
9899	76.3	29.6	105.9	72.0
9900	74.2	24.7	98.9	75.0
Means	48.7	17.1	65.8	74.0

Table 3 (cont).

Port Cluster 7

Season	Fall	Spring	Total	Percent Fall
8990	169.2	100.8	270.0	62.7
9091	192.7	89.0	281.7	68.4
9192	159.7	39.7	199.4	80.1
9293	170.3	47.5	217.8	78.2
9394	130.1	46.0	176.1	73.9
9495	105.2	44.0	149.2	70.5
9596	143.0	21.6	164.6	86.9
9697	125.5	16.6	142.1	88.3
9798	145.8	57.3	203.1	71.8
9899	147.2	56.3	203.5	72.3
9900	177.2	55.9	233.1	76.0
Means	151.4	52.2	203.7	75.4

Port Cluster 8

Season	Fall	Spring	Total	Percent Fall
8990	84.7	30.6	115.3	73.5
9091	111.9	40.1	152.0	73.6
9192	118.7	24.5	143.2	82.9
9293	96.3	41.8	138.1	69.7
9394	115.0	37.3	152.3	75.5
9495	54.2	20.1	74.3	72.9
9596	110.5	14.9	125.4	88.1
9697	108.8	13.1	121.9	89.3
9798	108.7	28.2	136.9	79.4
9899	79.9	42.0	121.9	65.5
9900	122.8	33.4	156.2	78.6
Means	101.0	29.6	130.7	77.2

Port Cluster 9

Season	Fall	Spring	Total	Percent Fall
8990	131.7	125.5	257.2	51.2
9091	239.0	104.6	343.6	69.6
9192	217.7	62.6	280.3	77.7
9293	207.7	103.5	311.2	66.7
9394	209.5	131.3	340.8	61.5
9495	146.2	69.3	215.5	67.8
9596	236.6	49.8	286.4	82.6
9697	208.3	34.3	242.6	85.9
9798	189.9	73.1	263.0	72.2
9899	168.3	87.6	255.9	65.8
9900	188.0	90.3	278.3	67.6
Means	194.8	84.7	279.5	69.9

Table 3. (cont).

Port Cluster 10

Season	Fall	Spring	Total	Percent Fall
8990	240.8	150.0	390.8	61.6
9091	345.9	143.9	489.8	70.6
9192	301.6	84.6	386.2	78.1
9293	219.0	84.6	303.6	72.1
9394	279.2	112.9	392.1	71.2
9495	159.3	63.0	222.3	71.7
9596	255.5	75.8	331.3	77.1
9697	267.0	52.6	319.6	83.5
9798	219.2	101.7	320.9	68.3
9899	211.4	118.0	329.4	64.2
9900	214.9	91.3	306.2	70.2
Means	246.7	98.0	344.7	71.7

Port Cluster 11

Season	Fall	Spring	Total	Percent Fall
8990	144.5	76.8	221.3	65.3
9091	204.3	86.0	290.3	70.4
9192	127.5	43.6	171.1	74.5
9293	129.6	37.8	167.4	77.4
9394	162.5	45.7	208.2	78.0
9495	95.0	48.1	143.1	66.4
9596	157.7	40.1	197.8	79.7
9697	230.0	34.2	264.2	87.1
9798	165.7	62.9	228.6	72.5
9899	153.6	88.8	242.4	63.4
9900	194.2	73.0	267.2	72.7
Means	160.4	57.9	218.3	73.4

Port Cluster 12

Season	Fall	Spring	Total	Percent Fall
8990	121.1	95.6	216.7	55.9
9091	124.3	66.9	191.2	65.0
9192	121.9	39.0	160.9	75.8
9293	117.7	44.9	162.6	72.4
9394	110.6	52.2	162.8	67.9
9495	71.1	47.1	118.2	60.2
9596	118.3	30.8	149.1	79.3
9697	122.0	24.6	146.6	83.2
9798	105.7	39.8	145.5	72.6
9899	89.0	57.6	146.6	60.7
9900	108.0	40.5	148.5	72.7
Means	110.0	49.0	159.0	69.6

Table 3. (cont.)

Port Cluster 13

Season	Fall	Spring	Total	Percent Fall
8990	89.9	94.5	184.4	48.8
9091	118.1	80.7	198.8	59.4
9192	104.9	43.7	148.6	70.6
9293	85.7	41.5	127.2	67.4
9394	73.2	53.8	127.0	57.6
9495	54.8	48.0	102.8	53.3
9596	108.7	41.9	150.6	72.2
9697	111.1	37.1	148.2	75.0
9798	112.2	64.1	176.3	63.6
9899	104.9	65.1	170.0	61.7
9900	123.4	53.6	177.0	69.7
Means	98.8	56.7	155.5	63.6

Table 4. Average catch (tonnes) per boat by fall and spring season by port cluster for seasons beginning from 1989-1999.

	Fall			Spring		
Port Cluster	Catch (tonnes)	Boats	Catch/Boat	Catch (tonnes)	Boats	Catch/Boat
1	15	11	1.3	7	7	1.0
2	39	40	1.0	17	27	0.6
3	91	74	1.2	40	54	0.7
4	105	85	1.2	43	57	0.8
5	32	32	1.0	19	21	0.9
6	49	47	1.0	17	33	0.5
7	151	62	2.4	52	49	1.1
8	101	46	2.2	30	32	0.9
9	195	61	3.2	85	61	1.4
10	247	100	2.5	98	92	1.1
11	160	77	2.1	58	56	1.0
12	110	37	3.0	49	36	1.4
13	99	54	1.8	57	46	1.2
	1393	726	1.9	572	569	1.0

Table 5. Average tonnes and pounds for LFA 33 port clusters from 1989-1999.

	Ave Tonnes			Ave Pounds			
Port Cluster	Fall	Spring	Total	Fall	Spring	Total	Percentage
1	14.8	6.8	21.6	32560	14960	47520	1
2	38.9	17.0	55.9	85580	37400	122980	3
3	91.4	40.1	131.5	201080	88220	289300	7
4	104.9	43.4	148.3	230780	95480	326260	8
5	31.5	19.0	50.5	69300	41800	111100	3
6	48.7	17.1	65.8	107140	37620	144760	3
7	151.4	52.2	203.6	333080	114840	447920	10
8	101.0	29.6	130.6	222200	65120	287320	7
9	194.8	84.7	279.5	428560	186340	614900	14
10	246.7	98.0	344.7	542740	215600	758340	18
11	160.4	57.9	218.3	352880	127380	480260	11
12	110.0	49.0	159.0	242000	107800	349800	8
13	98.8	56.7	155.5	217360	124740	342100	8
Total	1393.3	571.5	1964.8	3065260	1257300	4322560	100

Table 6. p-values for Fall area regressions. Shaded cells show p-values < 0.05.

	1	2	3	4	5	6	7	8	9	10	11	12
2	0.069											
3	0.161	0.004										
4	0.274	0.003	0.001									
5	0.296	0.002	0.001	0.007								
6	0.172	0.000	0.002	0.000	0.001							
7	0.388	0.412	0.951	0.781	0.553	0.560						
8	0.759	0.221	0.576	0.636	0.270	0.571	0.155					
9	0.425	0.580	0.781	0.717	0.798	0.854	0.431	0.010				
10	0.697	0.614	0.350	0.345	0.825	0.794	0.140	0.027	0.016			
11	0.979	0.056	0.213	0.125	0.022	0.055	0.401	0.044	0.179	0.118		
12	0.364	0.925	0.298	0.539	0.819	0.785	0.054	0.009	0.061	0.006	0.106	
13	0.359	0.002	0.147	0.060	0.055	0.011	0.054	0.020	0.150	0.176	0.013	0.089

Table 7. p-values for regression analyses among port clusters. Shaded cells are p-values that are <=0.05.

	1	2	3	4	5	6	7	8	9	10	11	12
2	0.004											
3	0.585	0.050										
4	0.405	0.564	0.039									
5	0.658	0.898	0.409	0.018								
6	0.892	0.315	0.029	0.000	0.003							
7	0.646	0.921	0.153	0.339	0.063	0.247						
8	0.885	0.222	0.001	0.177	0.524	0.233	0.052					
9	0.622	0.169	0.068	0.688	0.683	0.712	0.010	0.004				
10	0.564	0.620	0.079	0.136	0.082	0.225	0.000	0.024	0.005			
11	0.780	0.512	0.016	0.025	0.010	0.007	0.004	0.061	0.162	0.005		
12	0.827	0.904	0.382	0.725	0.126	0.631	0.000	0.110	0.006	0.000	0.028	
13	0.627	0.891	0.262	0.195	0.012	0.149	0.000	0.160	0.037	0.000	0.002	0.000

Table 6. p-values for Fall area regressions. Shaded cells show p-values < 0.05.

	1	2	3	4	5	6	7	8	9	10	11	12
2	0.069											
3	0.161	0.004										
4	0.274	0.003	0.001									
5	0.296	0.002	0.001	0.007								
6	0.172	0.000	0.002	0.000	0.001							
7	0.388	0.412	0.951	0.781	0.553	0.560						
8	0.759	0.221	0.576	0.636	0.270	0.571	0.155					
9	0.425	0.580	0.781	0.717	0.798	0.854	0.431	0.010				
10	0.697	0.614	0.350	0.345	0.825	0.794	0.140	0.027	0.016			
11	0.979	0.056	0.213	0.125	0.022	0.055	0.401	0.044	0.179	0.118		
12	0.364	0.925	0.298	0.539	0.819	0.785	0.054	0.009	0.061	0.006	0.106	
13	0.359	0.002	0.147	0.060	0.055	0.011	0.054	0.020	0.150	0.176	0.013	0.089

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8	0.885	0.222	0.001	0.177	0.524	0.233	0.052					
9	0.622	0.169	0.068	0.688	0.683	0.712	0.010	0.004				
10	0.564	0.620	0.079	0.136	0.082	0.225	0.000	0.024	0.005			
11	0.780	0.512	0.016	0.025	0.010	0.007	0.004	0.061	0.162	0.005		
12	0.827	0.904	0.382	0.725	0.126	0.631	0.000	0.110	0.006	0.000	0.028	
13	0.627	0.891	0.262	0.195	0.012	0.149	0.000	0.160	0.037	0.000	0.002	0.000

Table 8. Anova tables for port cluster voluntary logbook CPUE analysis of fall portion of the seasons.

Port Clusters 1-4 Fall (1986-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	20.988	5	4.19756	47.56	0
Week	67.031	7	9.57584	108.51	0
Year	8.138	13	0.62602	7.09	0
Error	16.15	183	0.08825		
Total	129.723	208			

Port Clusters 5-9 Fall (1984-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	100.675	17	5.9221	57.87	0
Week	312.92	7	44.7029	436.85	0
Year	37.981	15	2.5321	24.74	0
Error	74.394	727	0.1023		
Total	494.832	766			

Port Clusters 10-13 Fall (1993-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	13.22	4	3.305	35.13	0
Week	86.893	7	12.4132	131.93	0
Year	7.779	6	1.2965	13.78	0
Error	16.089	171	0.0941		
Total	126.277	188			

Table 9. Anova tables port cluster voluntary logbook CPUE analysis of spring portion of the seasons.

Port Clusters 1-4 Spring (1986-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	1.8419	2	0.92095	9.68	0.0007
Week	4.8639	5	0.97278	10.22	0
Year	4.4605	12	0.37171	3.91	0.0016
Error	2.5692	27	0.09516		
Total	15.4679	46			

Port Clusters 5-9 Spring (1984-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	28.158	16	1.75989	15.51	0
Week	34.581	7	4.94012	43.53	0
Year	37.501	15	2.50008	22.03	0
Error	45.06	397	0.1135		
Total	163.787	435			

Port Clusters 10-13 Spring (1993-1999)

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Fisher	26.7506	5	5.35013	23.39	0
Week	24.4678	7	3.4954	15.28	0
Year	5.1023	6	0.85038	3.72	0.0021
Error	26.0767	114	0.22874		
Total	96.8999	132			

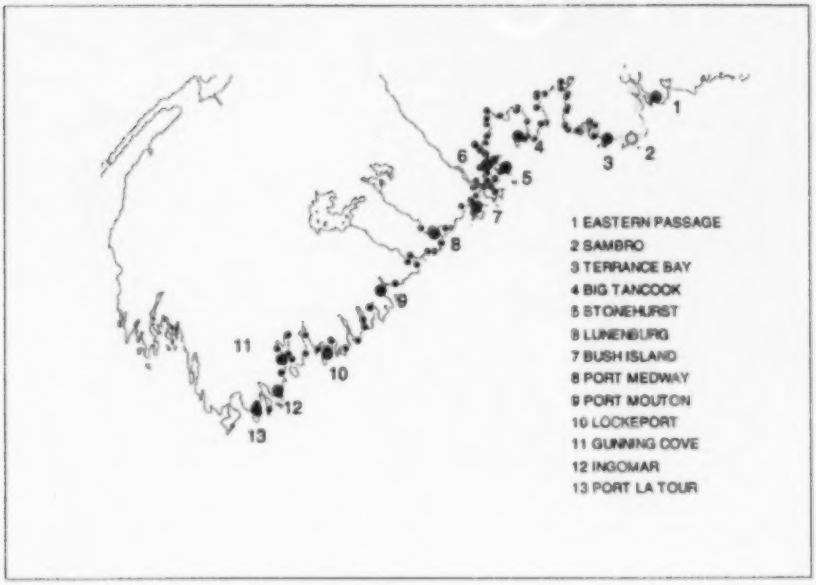

Fig. 1. Port Cluster boundaries for LFA 33 are indicated by different shadings. Main port in each cluster is identified.

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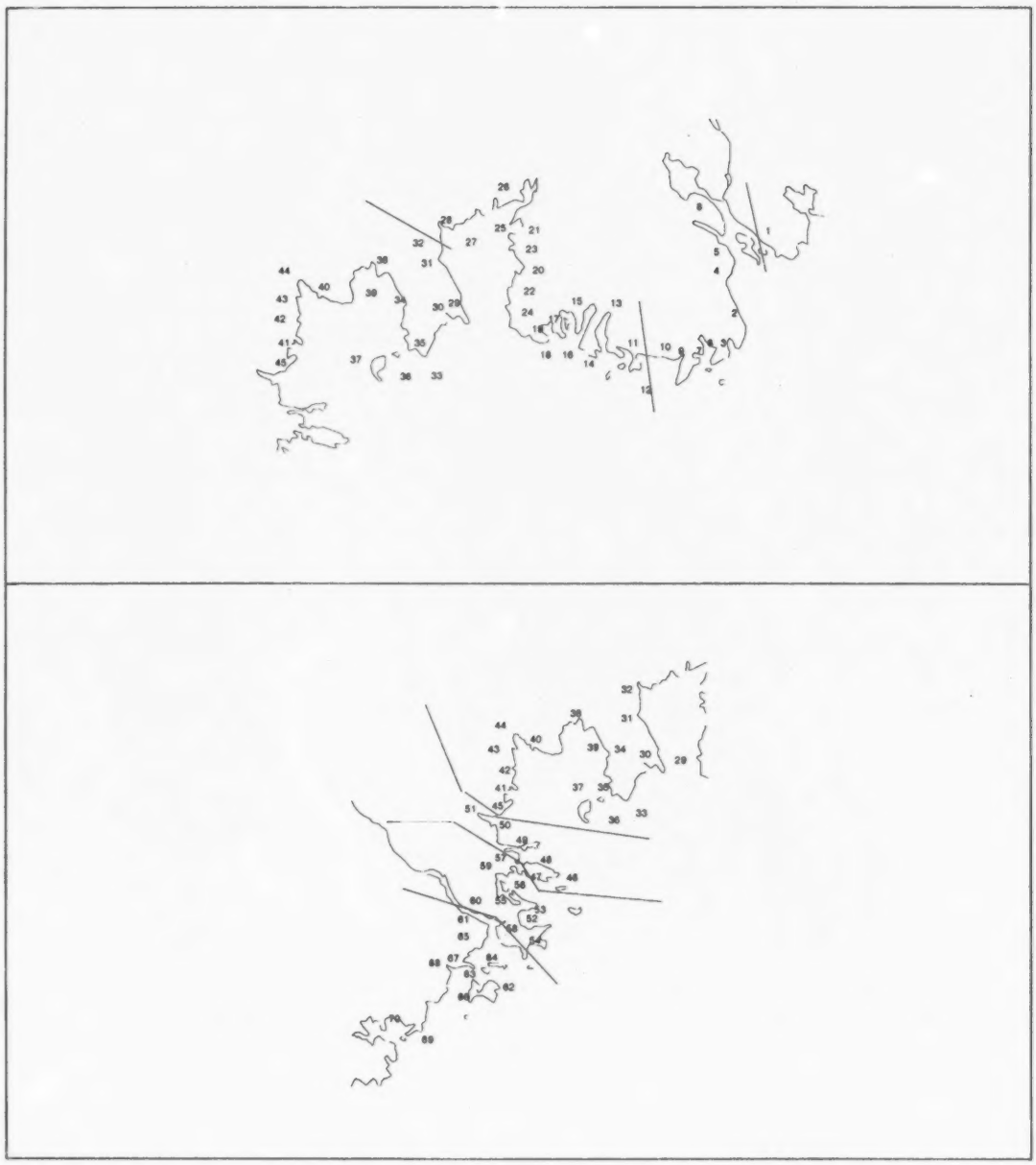

Fig. 2. Detailed map of ports with landings in each Port Cluster. Port Cluster codes are in Appendix 1.

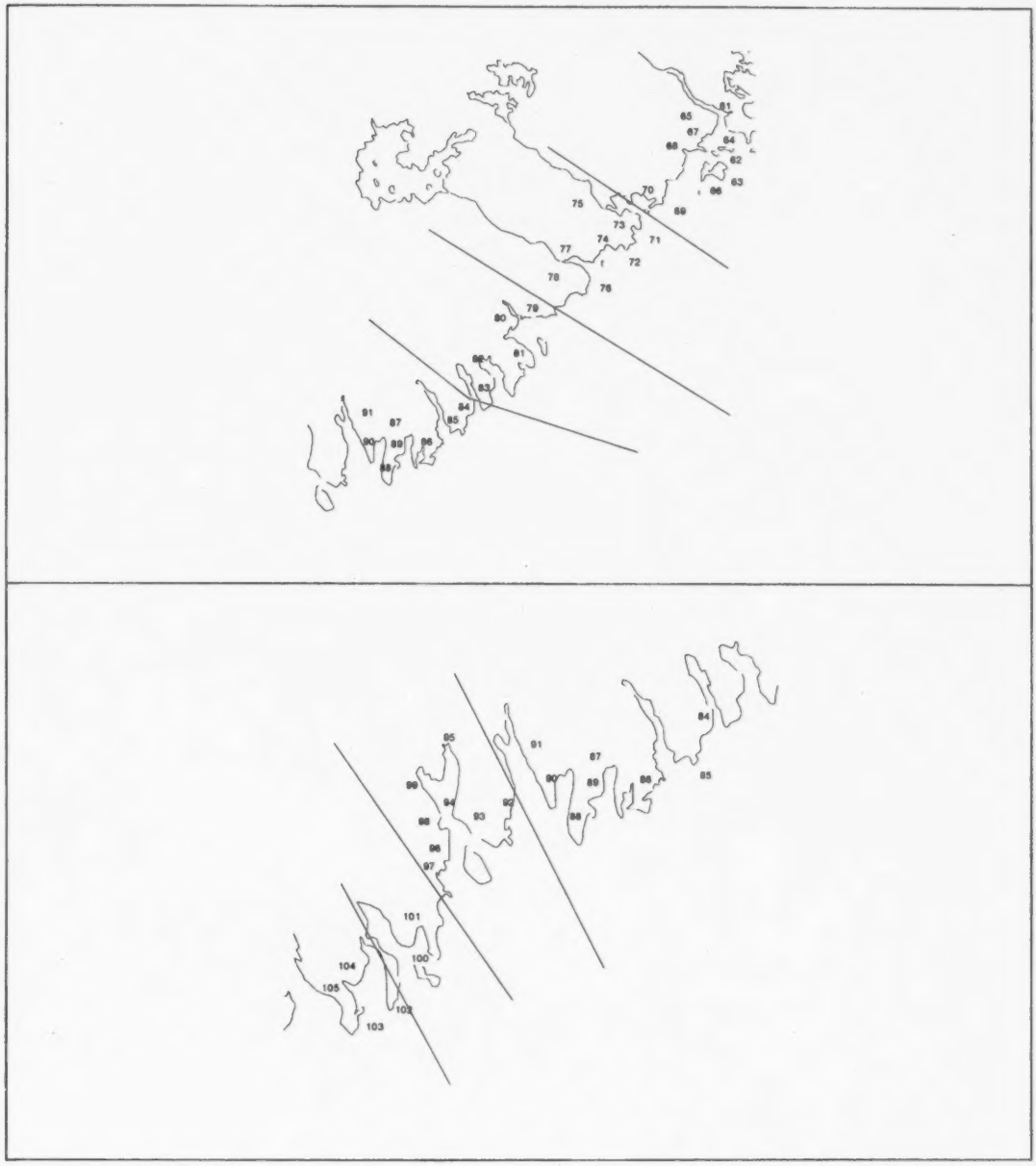

Fig. 3. Detailed map of ports with landings in each Port Cluster. Port Cluster codes are in Appendix 1.

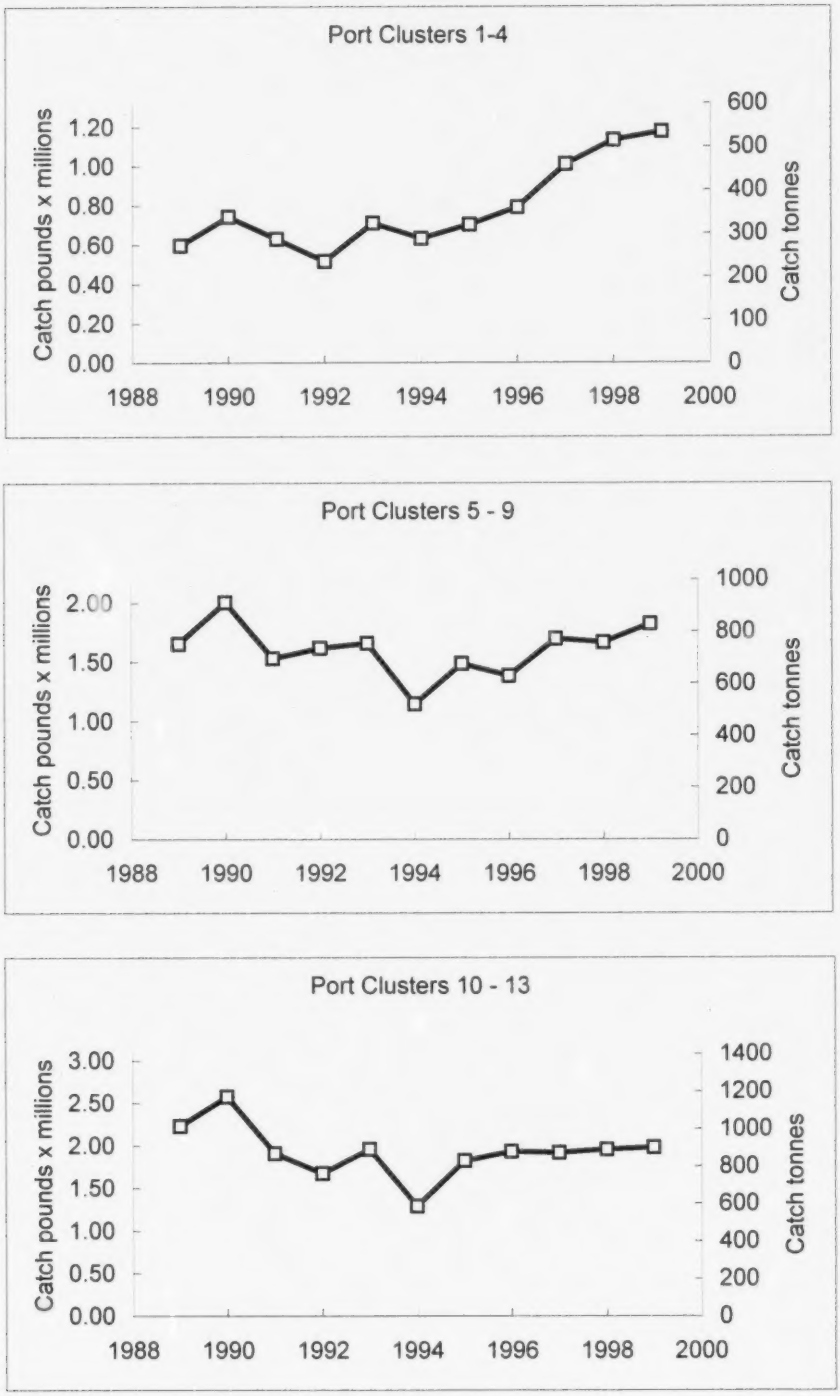

Fig. 4. Catch by groups of port clusters from 1989-1999 for spring and fall portions of seasons combined. Year indicated on the x-axis is the year that the season started on the last Monday in November.

Fig. 5. Scatterplots and regressions for fall landings among indicated port clusters. Regressions with p-values < 0.05 are shown by including linear predicted line.

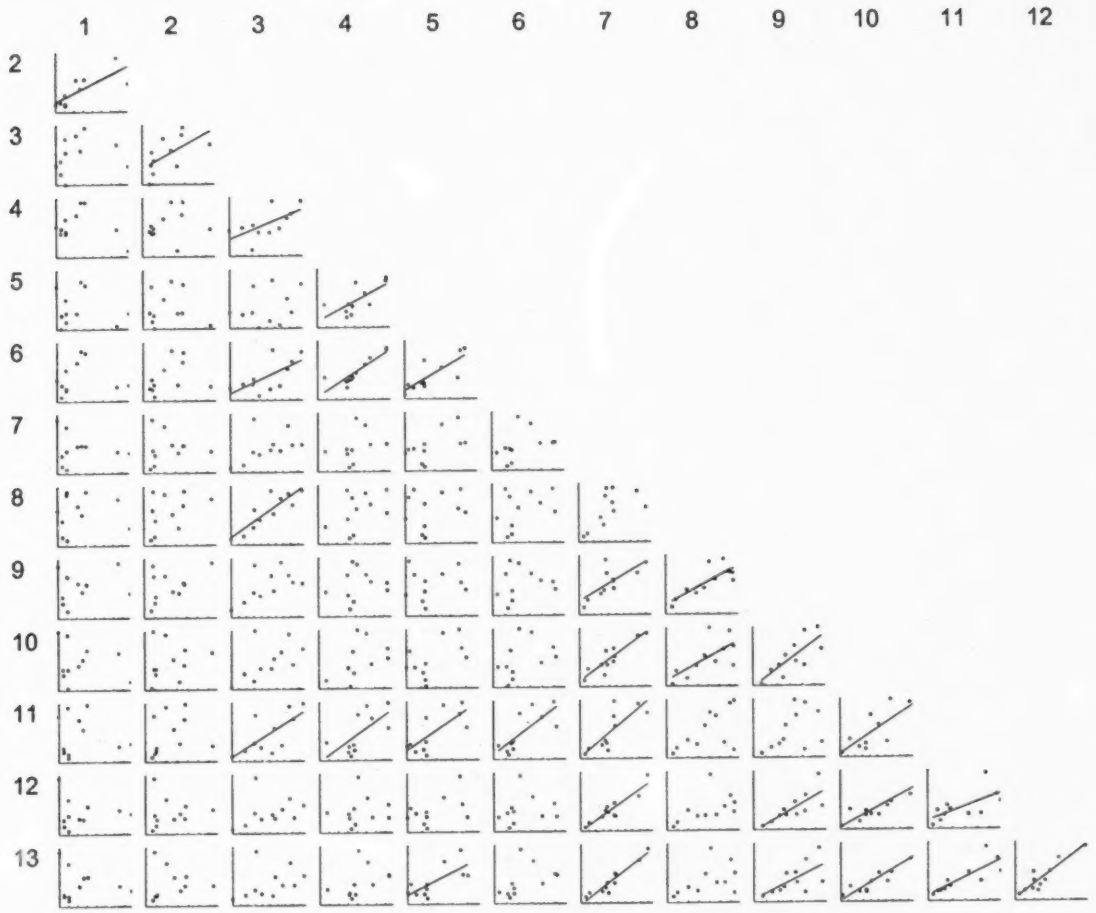

Fig. 6. Scatterplots and regressions for spring landings among indicated port clusters. Regressions with p-values < 0.05 are shown by including linear predicted line.

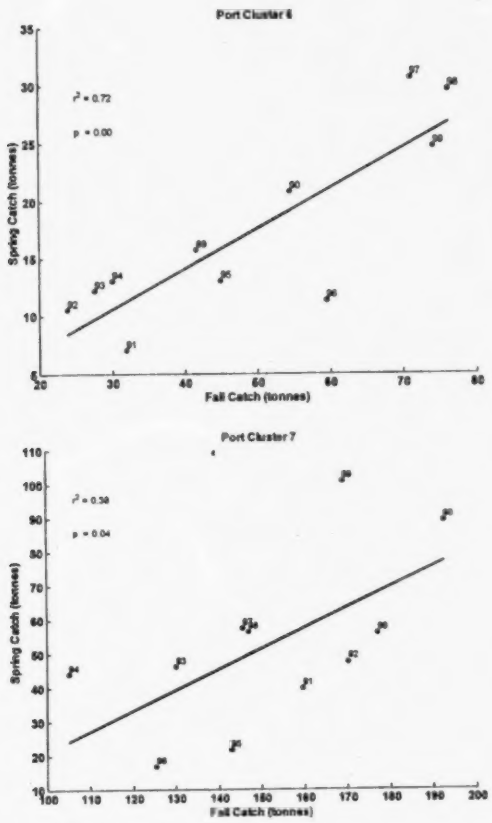

Fig. 7. Regression analysis between fall and spring catches for Port Clusters 6 and 7. All other port cluster relationships were not significant.

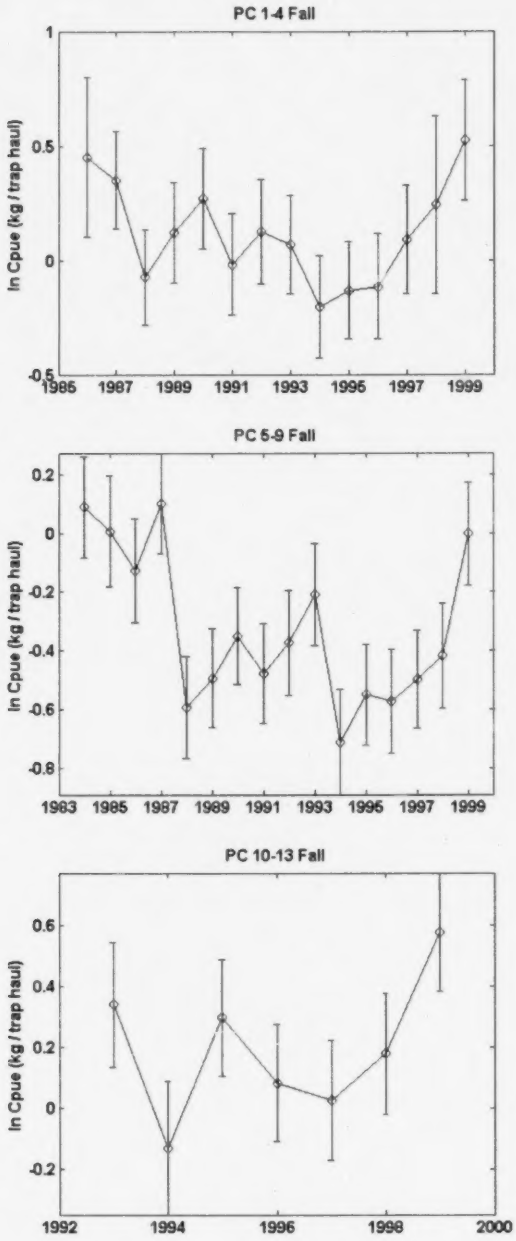

Fig. 8. CPUE (kg/trap haul) from voluntary logbooks for fall portion of the season from groups of indicated port clusters for LFA 33.

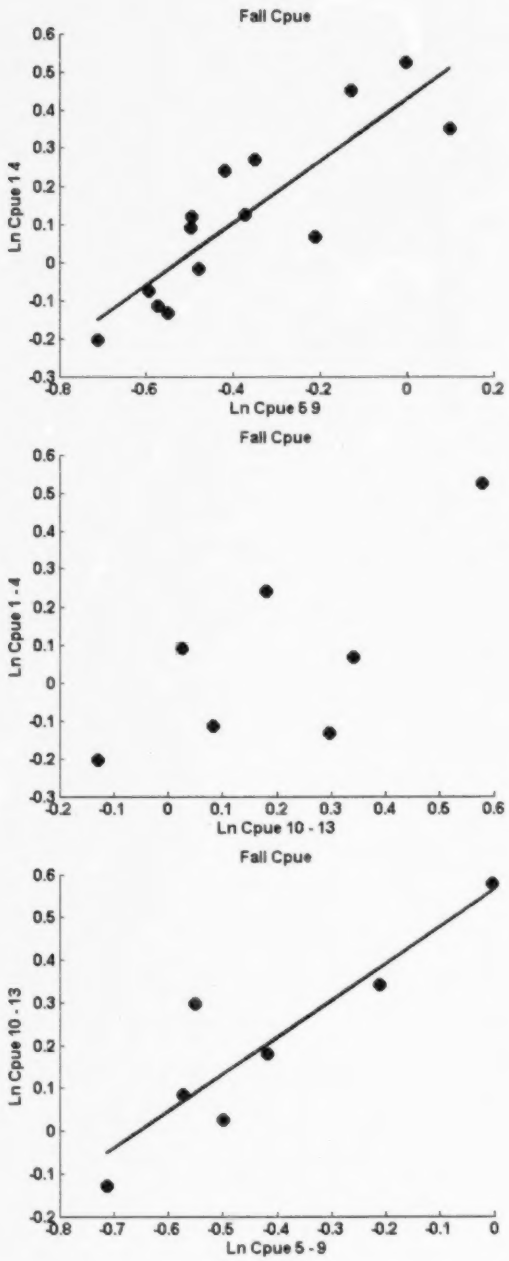

Fig. 9. Correlations in CPUE among port cluster groups for the fall portion of the season using analysis in Figs. 8.

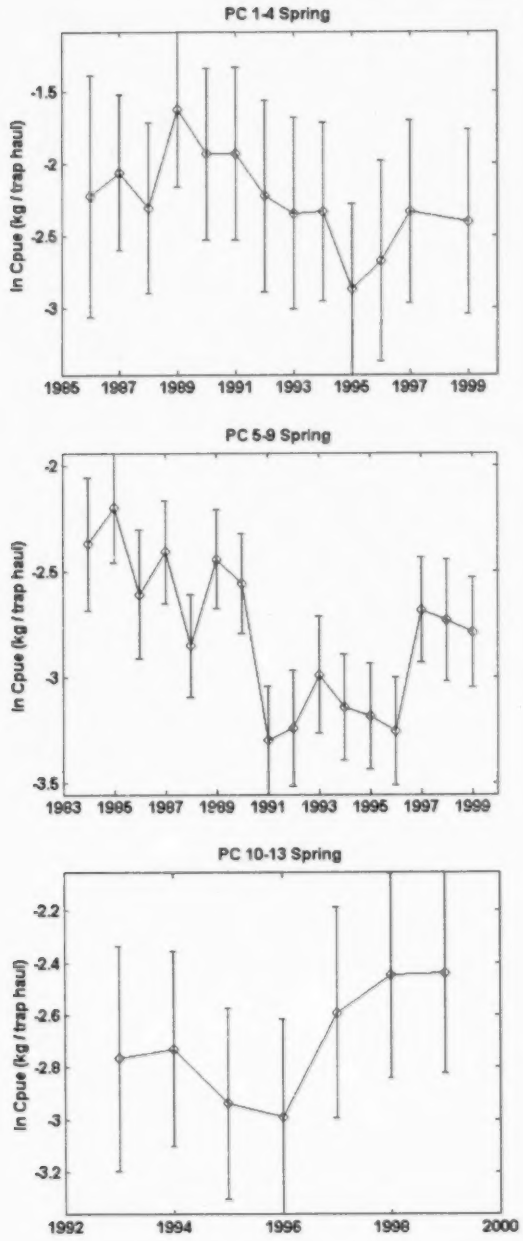

Fig. 10. CPUE (kg/trap haul) from voluntary logbooks for spring portion of the season from groups of indicated port clusters for LFA 33.

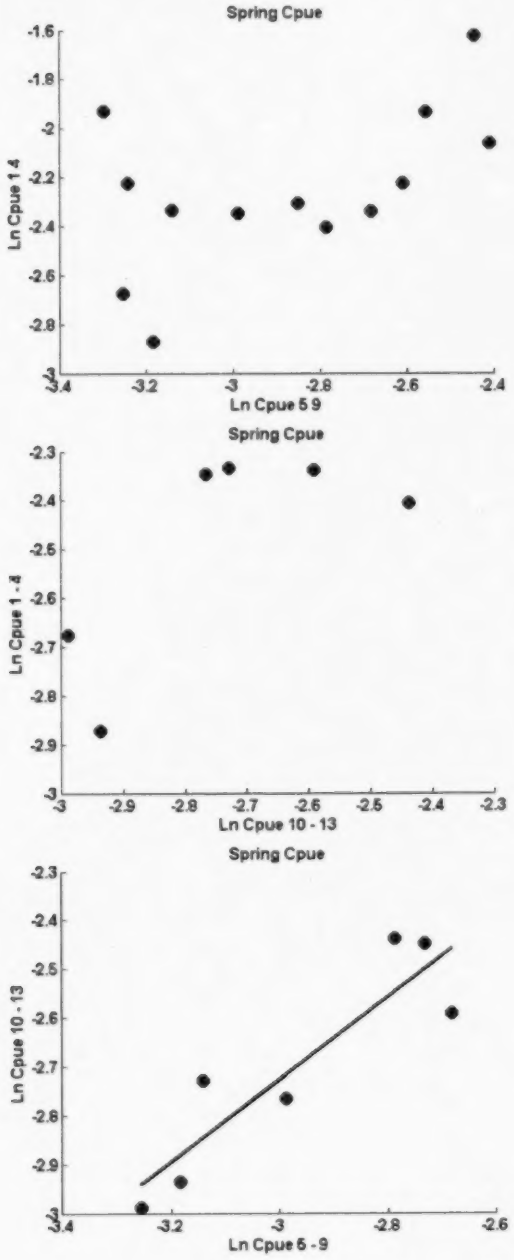

Fig. 11. Correlations in CPUE among port cluster groups for spring portion of the season using analysis in Figs. 10.

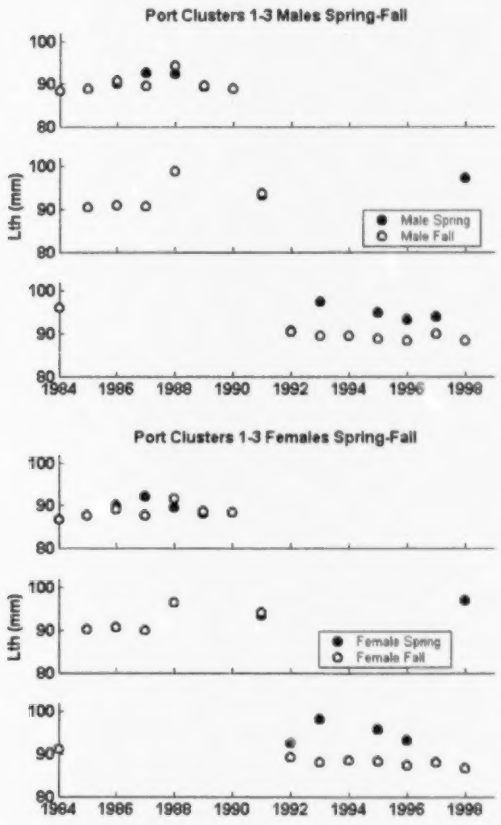

Fig. 12. Average carapace lengths for males and females measured in port sampling from port clusters 1 - 3 in LFA 33. Sequence for figures is port clusters 1 - 3 in order for males at top and females for the bottom three figures.

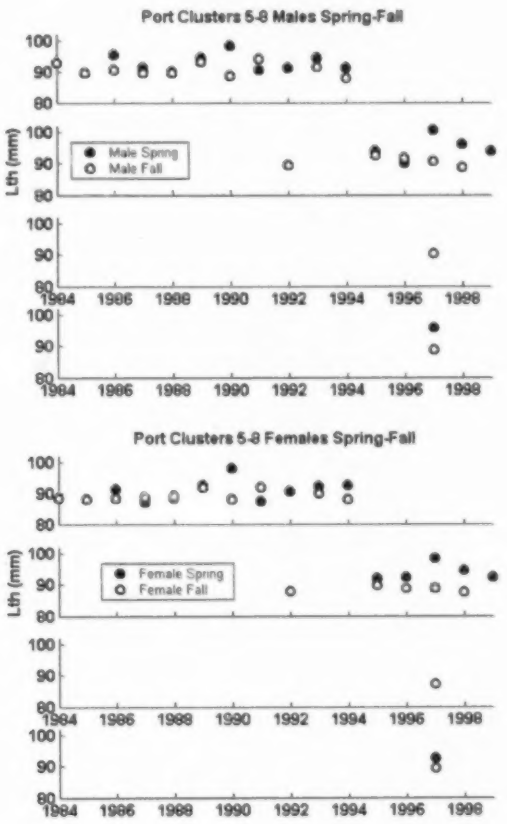

Fig. 13. Average carapace lengths for males and females measured in port sampling from port clusters 5 - 8 in LFA 33. Sequence for figures is port clusters 5 - 8 in order for males at top and females for the bottom four figures.

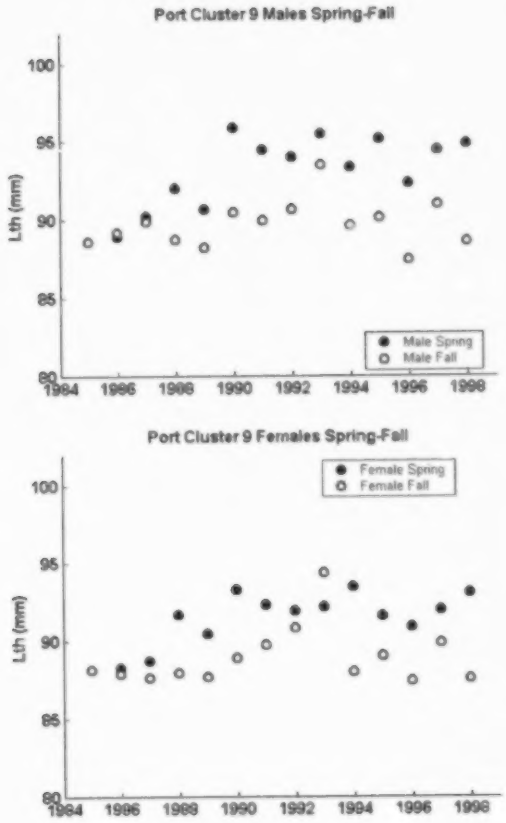

Fig. 14. Average carapace lengths for males and females measured in port sampling from port cluster 9 in LFA 33.

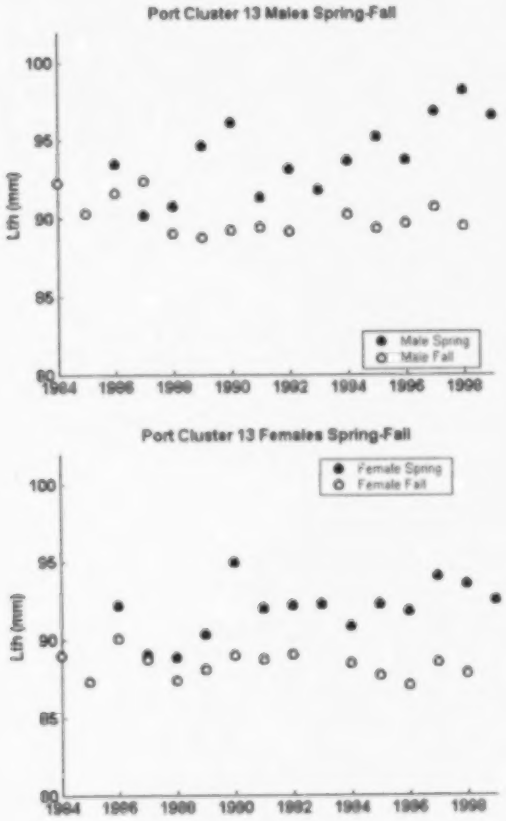

Fig. 15. Average carapace lengths for males and females measured in port sampling from port cluster 13 in LFA 33.

Appendix 1. Ports with landings in LFA 33 indciating county, Port Cluster, and geographic location.

Map No.	Port Code	Name	County	Port Cluster	Latitude	Longitude
1	11801	EASTERN PASSAGE	Halifax	1	44.6197	63.4797
2	12212	PORTUGUESE COVE	Halifax	2	44.5169	63.5381
3	12207	KETCH HARBOUR	Halifax	2	44.4797	63.5567
4	12206	HERRING COVE	Halifax	2	44.5700	63.5700
5	12214	PURCELL'S COVE	Halifax	2	44.5933	63.5700
6	12219	SAMBRO HEAD	Halifax	2	44.4797	63.5797
7	12201	SAMBRO	Halifax	2	44.4697	63.6000
8	12101	HALIFAX	Halifax	2	44.6497	63.6000
9	12209	PENNANT	Halifax	2	44.4697	63.6300
10	12221	WEST PENNANT	Halifax	2	44.4753	63.6542
11	12216	TERRANCE BAY	Halifax	3	44.4697	63.7197
12	12208	LOWER PROSPECT	Halifax	3	44.4500	63.7297
13	12215	SHAD BAY	Halifax	3	44.5200	63.7800
14	12213	PROSPECT	Halifax	3	44.4811	63.7872
15	12202	BAYSIDE	Halifax	3	44.5317	63.8075
16	12306	EAST DOVER	Halifax	3	44.4933	63.8517
17	12322	MCGRATH'S COVE	Halifax	3	44.5033	63.8583
18	12321	WEST DOVER	Halifax	3	44.4972	63.8697
19	12316	PEGGY'S COVE	Halifax	3	44.5042	63.9125
20	12309	GLEN MARGARET	Halifax	3	44.5794	63.9131
21	12307	FRENCH VILLAGE	Halifax	3	44.6281	63.9175
22	12310	HACKETT'S COVE	Halifax	3	44.5700	63.9200
23	12318	SEABRIGHT	Halifax	3	44.6206	63.9236
24	12313	INDIAN HARBOUR	Halifax	3	44.5200	63.9297
25	12303	BOUTILIER'S POINT	Halifax	3	44.6497	63.9500
26	12325	INGRAMPORT	Halifax	3	44.6700	63.9500
27	12317	QUEENSLAND	Halifax	3	44.6300	64.0300
28	12312	HUBBARDS	Halifax	3	44.6300	64.0697
29	12521	NORTHWEST COVE	Lunenburg	4	44.5300	64.0217
30	12501	ASPOTOGAN	Lunenburg	4	44.5247	64.0503
31	12518	MILL COVE	Lunenburg	4	44.5797	64.0697
32	12513	FOX POINT	Lunenburg	4	44.6197	64.0700
33	12520	NEW HARBOUR	Lunenburg	4	44.4722	64.0828
34	12509	DEEP COVE	Lunenburg	4	44.5333	64.1167
35	12505	BLANDFORD	Lunenburg	4	44.4811	64.1175
36	12515	LITTLE TANCOOK	Lunenburg	4	44.4697	64.1297
37	12503	BIG TANCOOK	Lunenburg	4	44.4811	64.1667
38	12511	EAST RIVER	Lunenburg	4	44.5806	64.1669
39	12512	EAST RIVER POINT	Lunenburg	4	44.5700	64.1700
40	12506	CHESTER	Lunenburg	4	44.5497	64.2500
41	12530	MARTIN'S POINT	Lunenburg	4	44.4797	64.3197
42	12528	WESTERN SHORE	Lunenburg	4	44.5250	64.3197
43	12534	GOLD RIVER	Lunenburg	4	44.5417	64.3197
44	12507	CHESTER BASIN	Lunenburg	4	44.5700	64.3197
45	12529	INDIAN POINT	Lunenburg	4	44.4542	64.3256

Appendix 1. (cont.)

Map No.	Port Code	Name	County	Port Cluster	Latitude	Longitude
46	12614	STONEHURST	Lunenburg	5	44.3697	64.2247
47	12603	BLUE ROCKS	Lunenburg	5	44.3533	64.2494
48	12616	SECOND PENINSULA	Lunenburg	5	44.3997	64.2800
49	12620	HERMAN'S ISLAND	Lunenburg	5	44.4194	64.3244
50	12610	MADER'S COVE	Lunenburg	5	44.4297	64.3497
51	12611	MAHONE BAY	Lunenburg	5	44.4500	64.3797
52	12609	LOWER ROSE BAY	Lunenburg	6	44.2800	64.2800
53	12605	FELTZON SOUTH	Lunenburg	6	44.3297	64.2800
54	12613	ROSE BAY	Lunenburg	6	44.2997	64.2997
55	12602	BAYPORT	Lunenburg	6	44.3200	64.3197
56	12625	CORKUM'S ISLAND	Lunenburg	6	44.3500	64.3197
57	12601	LUNENBURG	Lunenburg	6	44.3800	64.3197
58	12612	RIVERPORT	Lunenburg	6	44.2997	64.3297
59	12606	FIRST SOUTH	Lunenburg	6	44.3697	64.3497
60	12627	EAST LA HAVE	Lunenburg	6	44.3200	64.3700
61	12708	LAHAVE	Lunenburg	7	44.3044	64.3661
62	12742	BELL ISLAND	Lunenburg	7	44.2167	64.3667
63	12703	BUSH ISLAND	Lunenburg	7	44.2297	64.3700
64	12706	DUBLIN SHORE	Lunenburg	7	44.2700	64.3700
65	12740	PENTZ	Lunenburg	7	44.2950	64.3847
66	12709	CAPE LAHAVE ISLAND	Lunenburg	7	44.2042	64.3875
67	12712	WEST DUBLIN	Lunenburg	7	44.2531	64.4003
68	12710	PETITE RIVIERE	Lunenburg	7	44.2297	64.4500
69	12704	CHERRY HILL	Lunenburg	7	44.1497	64.5000
70	12711	VOGLER'S COVE	Lunenburg	7	44.1497	64.5300
71	12812	LONG COVE	Queens	8	44.1000	64.5500
72	12821	WEST BERLIN	Queens	8	44.0700	64.5797
73	12815	PORT MEDWAY	Queens	8	44.1300	64.5797
74	12807	EAGLE HEAD	Queens	8	44.0711	64.6150
75	12832	MILL VILLAGE	Queens	8	44.1497	64.6500
76	12813	MOOSE HARBOUR	Queens	8	44.0200	64.6700
77	12827	BROOKLYN	Queens	8	44.0539	64.7019
78	12801	LIVERPOOL	Queens	8	44.0300	64.7197
79	12811	HUNT'S POINT	Queens	9	43.9533	64.7803
80	12802	PORT MOUTON	Queens	9	43.9308	64.8508
81	12803	CENTRAL PORT MOUTON	Queens	9	43.9169	64.8542
82	12814	PORT JOLI	Queens	9	43.8667	64.9086
83	12809	EAST PORT HEBERT	Queens	9	43.8203	64.9372

Appendix 1. (cont.)

Map No.	Port Code	Name	County	Port Cluster	Latitude	Longitude
84	13012	PORT HEBERT	Shelburne	10	43.7997	64.9300
85	13020	JONES HARBOUR	Shelburne	10	43.7500	64.9667
86	13007	LITTLE HARBOUR	Shelburne	10	43.7197	65.0300
87	13002	ALLENDALE	Shelburne	10	43.7500	65.0997
88	13001	LOCKEPORT	Shelburne	10	43.7000	65.1200
89	13010	OSBORNE HARBOUR	Shelburne	10	43.7197	65.1200
90	13016	WEST GREEN HARBOUR	Shelburne	10	43.7197	65.1700
91	13004	EAST JORDAN	Shelburne	10	43.7694	65.2275
92	13112	JORDAN BAY	Shelburne	11	43.7000	65.2300
93	13115	LOWER SANDY POINT	Shelburne	11	43.6817	65.2981
94	13125	SANDY POINT	Shelburne	11	43.7000	65.3197
95	13101	SHELBURNE	Shelburne	11	43.7700	65.3197
96	13107	CARLETON VILLAGE	Shelburne	11	43.6692	65.3353
97	13110	GUNNING COVE	Shelburne	11	43.6797	65.3497
98	13108	CHURCHOVER	Shelburne	11	43.7197	65.3700
99	13123	ROSEWAY	Shelburne	12	43.6300	65.3497
100	13117	NORTH EAST HARBOUR	Shelburne	12	43.5542	65.3633
101	13111	INGOMAR	Shelburne	12	43.5700	65.3700
102	13105	BLANCHE	Shelburne	12	43.4983	65.4110
103	13126	SMITHVILLE	Shelburne	13	43.4833	65.4667
104	13127	UPPER PORT LA TOUR	Shelburne	13	43.5200	65.4697
105	13120	PORT LA TOUR	Shelburne	13	43.5000	65.4800

Appendix 2. Workshop minutes.

LFA 33 lobster workshop, Sambro N.S. **October 10, 2000.**

Attendees:

Industry:		DFO:	Ross Claytor
Raymond Naugle	E. Passage		Stephen Nolan
Wayne Eddy	E. Passage		Ron Duggan
James Gray	Sambro	FSRS:	Carl MacDonald
David Gray	Sambro		
Patrick Gray	Sambro		
Victor Gray	Sambro		
Lionel Young	Terence Bay		

Following a round table introduction, fishers were asked to give an individual perspective of the fishery in their respective areas.

Fishers from Sambro and Dover felt that lobster stocks are in good shape for the following reasons,

a) Effort has been increasing for the past few years but individual landings are still increasing by a small amount each year.
b) The area fished has increased slightly by moving further offshore but lobsters aren't found in deeper water as in ports further west. Maximum depth fished is 25 fathoms.
c) More fishers are fishing more traps and more days in spring than in the past when groundfish were more plentiful.
d) More kelp and fewer urchins on bottom than in 1980's.
e) Absence of groundfish lessens predation on small lobsters.

Fishers from Eastern Passage thought landings were holding steady for last 5 years but are shared among more licenses than in the past. They agreed that more effort is expended in spring than in 1980's. The fishery takes place in 5-25 fathoms and grounds have expanded only slightly. Lobsters didn't move to shallower nearshore water as usual last spring.

Individual observations put forth in support of stable lobster stocks included:

a) The silver hake fishery depleted hake stocks that provided spawn for deep-water lobsters to feed on. Since the fishery ended, hake is more abundant and lobsters are more plentiful.
b) The number of draggers has declined to about one tenth of the 700 that operated at one time. The trawl design has changed and is less harmful to the bottom, which allows for better lobster habitat.

Areas of joint and individual concern for future of the lobster fishery were also advanced.

a) The seal population is still growing and fishers are concerned about increased lobster predation.
b) Warm water in early part of 1998 and 1999 spring fishery resulted in unusual amount of large females being landed and we should be concerned about recruitment in 7-8 years.

Carl MacDonald gave a brief presentation on the FSRS recruitment study. To date, data analysis for the spring portion of the 1999 season has been completed.

Recent and historical CPUE data from voluntary logs and length frequency data from port sampling were presented by R. Claytor. Fishers requested that from now on data be presented in inches and pounds as still used by buyers and shippers. The consensus was that voluntary logbook data provides an accurate description of the CPUE trends in the fishery. Steve Nolan explained that port sampling data, (length frequencies), are collected at a consistent time of year from unsorted catches and from a number of boats from each port. Given these sampling conditions it was agreed that the length frequencies presented were consistent with observations of those fishing in the area. He also noted that there was a scarcity of logkeepers from the eastern end of LFA 33 and made an appeal for those present to consider keeping individual logs. Two attendees said they would try to get some of their colleagues to keep logs. The current system used by statistics branch for calculating annual landings from mandatory logs was thought to be inefficient and probably underestimates total landings by about 10-15%. The underestimation is consistent from year to year.

Ross Claytor outlined a project designed to learn more about lobster abundance by conducting short term tag, release, and recovery. A discussion followed about the timing of such a project and why it could not be conducted during the fall fishery. The explanation that utilization of time and resources would be more efficient and provide more and better data during a short term concentrated project was accepted. It was indicated that this project would not serve as a trade off for future conservation measures. Fishers expressed concern about poaching of traps during a pre-season project. Fishers from port clusters 2 and 3 agreed to participate depending on the outcome of cost sharing arrangements. Fishers were in favour of research activities conducted on a more local basis because they feel conditions differ from port to port and recommended that at least two sites be tested. A follow up meeting will be held to finalize details.

LFA 33 lobster workshop, Bridgewater N.S. **October 3, 2000.**

Attendees:

Industry:		DFO:	Ross Claytor
Myles Bush	West Dublin		Stephen Nolan
Gary Tanner	Bayport		Ron Duggan
Keith Bush	West Dublin	FSRS	Kory Jollimore
Jaan Kariler	Rose Bay		
Dale Cook	First South		
Austin Green	Lunenburg		
Barry Levy	Bridgewater		
Junior Risser	Riverport		
Michael Lunn	Hunts Point		
Stephen Scobey	Liverpool		

Following a round table introduction, fishers were asked to give an individual perspective of the fishery in their respective areas. From this there appeared to be general consensus on several points.

a) Landings are high compared to those in the late 70s and early 80s and there is no real concern for future of fishery given current regulations.
b) Except for one fisher, landings have increased or at least remained stable for the past 4-5 years.
c) Fishers have been expanding area fished by moving gear to deeper water since mid 1980's. i.e. from 15 fathoms to as much as 40 fathoms in some areas.
d) Larger run of lobsters from deeper water at first but average size has since decreased.
e) Water temperatures are higher than 1980's. Non native fish thought to have come from southern waters were observed .
f) Lobster movement to deeper water in fall and back onshore spring-summer.

Some individual observations were also put forth:

c) Landings are the same but have to work harder and fish more ground to maintain.
d) Deeper water lobsters are not on hard bottom.
e) Fishing large lobsters from an area makes more ground available for smaller lobsters.
f) Absense of groundfish inshore allows more small lobsters to survive.
g) Seals are major predators on lobster.
h) Appears to be a concentration of berried females on a 24-30 fathom ridge in fall

Kory Jollimore gave a brief presentation on the FSRS recruitment study. (See attachment) To date, data analysis for the spring portion of the 1999 season has been completed.

Recent and historical CPUE data from voluntary logs and length frequency data from port sampling, were presented by R. Claytor. The consensus was that voluntary logbook data provides an accurate description of the CPUE trends in the fishery. It was explained that port sampling data are collected at a consistent time of year from unsorted catches and from a number of boats from each port. Given these sampling conditions it was agreed that the length frequencies presented were consistent with observations of those fishing in the area. The current system for calculating annual landings from mandatory logs was thought to be inefficient and to

underestimate total landings. The underestimation is consistent from year to year. The current system does not produce timely reports on landings.

Ross Claytor outlined a project designed to learn more about lobster abundance by conducting short term tag, release, and recovery. Fishers were in favour of research activities conducted on a more local basis because they feel conditions differ from port to port. It was agreed that the best geographic location for these projects would be one bay or fishing area that would represent port clusters 5-7 combined and one bay or fishing area that would represent port clusters 8-9 combined. A number of attendees volunteered to assist by providing manpower and vessel time. It was agreed that late summer - early fall would be the best time to conduct tests. A follow up meeting will be called to finalize details.

LFA 33 lobster workshop, Jordan Bay, N.S. **October 19, 2000.**

Attendees:

Industry:		DFO:	Ross Claytor
David Nickerson	RR3 Shelburne		Stephen Nolan
Fred Perry	Port Saxon		Ron Duggan
Cecil Williams	Sable River		
Gordon Atwood	Barrington	FSRS:	Kory Jollimore
William Acker	RR2 Shelburne		
Robert Lloyd	Osborne Hbr.		
Wade Hemeon	RR2 Shelburne		
Shane Blenkhorn	RR2 Shelburne		
Ernie Pierce	RR2 Shelburne		
John Acker	RR2 Shelburne		
Robert Hopkins	RR2 Shelburne		
Alex Bower	Jordan Bay		
Wilford Smith	Port Latour		
Ricky Hallet	Lockeport		

Following a round table introduction, fishers were asked to give an individual perspective of the fishery in their respective areas.

Fishers from port cluster 10 felt that lobster stocks are still holding up because although there are more boats in the area now and many are fishing more days per season, landings have been steady with minor fluctuations for the last 5 years. The fishery in this area extends to about 20 fathoms. Concern was expressed as to what effect a salmon farm might have on absence of lobsters in an area where they were previously found.

Port cluster 11 fishers reported slight increases in landings over last 5 years. Several indicated that they are fishing "longer and harder'. The area fished has been moving further from shore each year and in some cases individuals are out to 30 fathoms and feel that they will have to move out more in the next few years. One comment indicated that the last 5 years were the best of the last 15.

Port cluster 12 reported that although they have been moving to deeper water over the last 5 years, they are maintaining good landings by working harder. The main body of lobsters appears to concentrate further offshore than in past. There are more lobsters on more open bottom and the reason for this is thought to be the absence of predators due to downturn in groundfish. Fishery extends to 25 fathoms.

Port cluster 13: The one representative from this area said that fishers had moved off to deeper water as much as 15-20 years ago and some are now at 40 fathoms. Landings per boat are holding steady but number of boats has increased from 15 to 70. Also, several boats now fish throughout entire 6 months of season. There are more small, (3"- 4" overall length) and more lobsters on all types of bottom where they couldn't catch any 5-6 years ago. They feel that this is due to a combination of warmer water and fewer predators.

One interesting idea shared by several fishers from different areas was that if an attempt is made to fish on bottom where there are very few lobsters, there will be lobsters in that area in the following year. It appears that lobsters will move to the area if it is "baited". It was generally agreed that there is a larger run of lobsters from deeper water and that spring run of lobsters is larger than in the fall. Large "fantail" female lobsters are caught later in the spring in shallow water.

Kory Jollimore gave a brief presentation on the FSRS recruitment study. To date, data analysis for the spring portion of the 1999 season has been completed which shows varying numbers of pre recruit lobsters are caught for different LFA's.

Recent and historical CPUE data from voluntary logs and length frequency data from port sampling were presented by R. Claytor. After some discussion on the validity of data from individual voluntary logs a consensus was reached that voluntary logbook data provides an accurate description of the CPUE trends in the fishery. Steve Nolan explained that port sampling data, (length frequencies), are collected at a consistent time of year from unsorted catches and from a number of boats from each port. Given these sampling conditions it was agreed that the length frequencies presented were consistent with observations of those fishing in the area. He also noted that there was a scarcity of logkeepers from the some areas of LFA 33 and made an appeal for those present to consider keeping individual logs. Fishers requested that from now on data is presented in inches and pounds as still used by buyers and shippers. The current system used by statistics branch for calculating annual landings from mandatory logs was thought to be inefficient and probably underestimates total landings by about 10-15%. The underestimation is consistent from year to year.

Ross Claytor outlined a project designed to learn more about lobster abundance by conducting short term tag, release, and recovery. It was indicated that this project would not serve as a trade off for future conservation measures. Fishers were in favour of research activities conducted on a more local basis because they feel conditions differ from port to port and recommended that at least two sites be tested. A follow up meeting will be held to finalize details.

LFA 33 lobster workshop, Bridgewater N.S. **February 18, 2001.**

Name	Location
Robert Swim	Port Mouton
Jack Dunlop	Port Cluster 9
Rick Clottenburg	Hunt's Point
Winfred Risser	Riverport
Barry Levy	Bridgewater/ Lunenburg
Jim Jamieson	DFO
Bradford Crouse	Liverpool East
Stephen Scobey	Mersey Point
Moyle L. Tumblin	La Have
Ross Claytor	DFO

Ross Claytor presented an outline of data and preliminary analytical results that would be used to examine associations among fisheries in port clusters 1-13 in LFA 33, catch rates in LFA 41, and the effect of temperature on lobster trap catch rates using the FSRS recruitment trap data.

The presentation on the associations among port clusters began with a description of the number of boats and catch per boat by fall and spring portions of the season in each port cluster. Correlations among the port clusters for catches indicated that port clusters 1-5 and 8-13 formed two groups of associated port clusters with 6 and 7 being intermediate. The only port clusters where fall landings and spring landings were associated were port clusters 6 and 7. Port clusters were grouped into 1-4, 5-9, and 10-13 for catch rate analysis based on voluntary logbook reports for the fall portion of the season. Catch rates in each of these three areas increased appreciably during the fall season in each of the groups. All three groups were correlated for fall season for the years of common data collection.

Analysis of LFA 41 catch rates indicated an increase in catch rates in the most recent year compared to last years analysis. In general Crowell Basin was distinct from Georges Bank in terms of landing and catch rate trends in LFA 41. The other areas were intermediate. An initial look at temperature was inconclusive and more work is required.

The FSRS data indicated that in general for the fall portion of the season temperature influences catch rate and that it might make up to a 5% difference in exploitation rate on average for all areas. Additional work is required to determine the reasons for differences among areas and the uncertainty involved in these estimates. The FSRS data looks very promising as a method for sorting out the relationship between temperature and catch rates.

Industry comments:

- The number of boats fishing in spring 1998-1999 was too low.
- The split between port clusters 1-6 and 7-13 was reasonable
- B licenses should be split out from the number of boats. There is one in port cluster 9, and other areas have abouit 1-4.
- The catches in the logbooks could be used to check correlations among areas if individual fishermen are consistent among years and between areas, but could be used to check on fall to spring correlations.
- Depth is a likely important factor in affecting CPUE.
- During the late 1980s there was an increase in berried females.
- Localized native fisheries are important.

LFA 33 lobster workshop, Jordan Bay N.S. February 19, 2001.

Name	Location
Fred Perry	Ingomar
David Nickerson	Ingomar
Robert Lloyd	Osborne Harbour
James D. Benham	Osborne Harbour
Ernie Pierce	Jordan Bay
Jim Jamieson	DFO
Wilfred Smith	Port La Tour
Allen B. Holmes	NSDFA
Ross Claytor	DFO

Ross Claytor presented an outline of data and preliminary analytical results that would be used to examine associations among fisheries in port clusters 1-13 in LFA 33, catch rates in LFA 41, and the effect of temperature on lobster trap catch rates using the FSRS recruitment trap data.

The presentation on the associations among port clusters began with a description of the number of boats and catch per boat by fall and spring portions of the season in each port cluster. Correlations among the port clusters for catches indicated that port clusters 1-5 and 8-13 formed two groups of associated port clusters with 6 and 7 being intermediate. The only port clusters where fall landings and spring landings were associated were port clusters 6 and 7. Port clusters were grouped into 1-4, 5-9, and 10-13 for catch rate analysis based on voluntary logbook reports for the fall portion of the season. Catch rates in each of these three areas increased appreciably during the fall season in each of the groups. All three groups were correlated for fall season for the years of common data collection.

Analysis of LFA 41 catch rates indicated an increase in catch rates in the most recent year compared to last years analysis. In general Crowell Basin was distinct from Georges Bank in terms of landing and catch rate trends in LFA 41. The other areas were intermediate. An initial look at temperature was inconclusive and more work is required.

The FSRS data indicated that in general for the fall portion of the season temperature influences catch rate and that it might make up to a 5% difference in exploitation rate on average for all areas. Additional work is required to determine the reasons for differences among areas and the uncertainty involved in these estimates. The FSRS data looks very promising as a method for sorting out the relationship between temperature and catch rates.

Industry comments:

- Check on B licenses, Cape Sable island also has about 20 boats that fish in LFA 33 to improve analysis of number of boats
- Remove spring 1998-1999 from analysis it is too low
- No B licenses in port cluster 13
- West Halifax to Lunenburg different from other areas
- Spring season had easterly winds, instead of dividing go into Green Harbour
- Inside fishing was not as good as last year
- Those that stayed inside did not do as well as those that went outside.
- Effort is outside, and farther and farther, baiting is making new bottom
- What is the influence of herring seiner catches on lobster CPUE

LFA 33 lobster workshop, Sambro, N.S. February 20, 2001.

Name	Location
Victor Gray	Sambro
James M. Gray	Sambro
Stephen Gray	Ketch Harbour
John Sihru	Cow Bay
Tom Henneberry	Eastern Passage
Patrick Gray	Sambro Harbour
Gerald Mason	NSAF
Jeff Graves	FSRS
Vincent Boutilier	Port Cluster 4B
Eugene D Young	Hubbards
Lionel Young	Hubbards
Bill Bell	Hubbards
Kevin Duffy	Terence Bay

Ross Claytor presented an outline of data and preliminary analytical results that would be used to examine associations among fisheries in port clusters 1-13 in LFA 33, catch rates in LFA 41, and the effect of temperature on lobster trap catch rates using the FSRS recruitment trap data.

The presentation on the associations among port clusters began with a description of the number of boats and catch per boat by fall and spring portions of the season in each port cluster. Correlations among the port clusters for catches indicated that port clusters 1-5 and 8-13 formed two groups of associated port clusters with 6 and 7 being intermediate. The only port clusters where fall landings and spring landings were associated were port clusters 6 and 7. Port clusters were grouped into 1-4, 5-9, and 10-13 for catch rate analysis based on voluntary logbook reports for the fall portion of the season. Catch rates in each of these three areas increased appreciably during the fall season in each of the groups. All three groups were correlated for fall season for the years of common data collection.

Analysis of LFA 41 catch rates indicated an increase in catch rates in the most recent year compared to last year's analysis. In general Crowell Basin was distinct from Georges Bank in terms of landing and catch rate trends in LFA 41. The other areas were intermediate. An initial look at temperature was inconclusive and more work is required.

The FSRS data indicated that in general for the fall portion of the season temperature influences catch rate and that it might make up to a 5% difference in exploitation rate on average for all areas. Additional work is required to determine the reasons for differences among areas and the uncertainty involved in these estimates. The FSRS data looks very promising as a method for sorting out the relationship between temperature and catch rates.

Industry comments:

- In port cluster 2 there were about 8 too many, and there are about 3 B Licenses.
- 1999 seemed ok
- In port cluster 1 there are about 17 licenses now.
- Port cluster 3 is ok, about 70 licenses
- Port cluster 4 was not sure.
- Port cluster 3 fall and spring should be about equal
- In port cluster 2 it should be equal in last two years, but there may be about a 5 boat difference
- In port cluster 1 there are less in spring than fall
- Water warms up more quickly in Shelburne and Liverpool at about two weeks before St. Margaret's Bay

- Timing of spring is important for landings
- In port cluster 1 more fishing was at 20-30 fathoms
- Urchin die off in 1996-97
- For 2000 port cluster 4 predicts lower catch rates because of sea urchins
- Sea urchins take over bottom
- A type of green moss is a problem
- Green crab are becoming a concern
- Size increase and V-notching too much change too quickly
- Difficult to sell larger lobsters to buyers
- Remember that 133-134 licenses are set to retire in LFA 33, B Licenses and part time
- In port cluster 1 off shore when season started
- Freshwater table in deep water
- In port cluster 4A, St. Margarets Bay, not many in 8-10 fathoms, most 5-6 fathoms
- In 4B Indian Pt. About 30% down from last year, same for Mahone Bay

Appendix 3.1. Port samples collected from port cluster 1.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	394	320	0	714	88.36	86.70	87.62	558	535	548
Fall	1985	450	379	0	829	88.94	87.60	88.33	569	551	561
Fall	1986	392	298	0	690	90.77	89.03	90.02	606	577	593
Fall	1987	361	321	0	682	89.67	87.75	88.77	584	554	570
Fall	1988	127	108	0	235	94.32	91.68	93.11	682	628	657
Fall	1989	207	212	0	419	89.66	88.56	89.10	583	568	576
Fall	1990	174	161	0	335	88.82	88.35	88.59	567	565	566

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	394	320	0	714	3.48	3.41	3.45	1.23	1.18	1.21
Fall	1985	450	379	0	829	3.50	3.45	3.48	1.25	1.22	1.24
Fall	1986	392	298	0	690	3.57	3.51	3.54	1.34	1.27	1.31
Fall	1987	361	321	0	682	3.53	3.45	3.49	1.29	1.22	1.26
Fall	1988	127	108	0	235	3.71	3.61	3.67	1.50	1.38	1.45
Fall	1989	207	212	0	419	3.53	3.49	3.51	1.29	1.25	1.27
Fall	1990	174	161	0	335	3.50	3.48	3.49	1.25	1.24	1.25

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	354	351	0	705	89.97	90.13	90.05	585.54	597.75	591.62
Spring	1987	163	177	0	340	92.59	92.21	92.39	639.57	638.20	638.85
Spring	1988	171	171	0	342	92.49	89.69	91.09	637.49	589.47	613.48
Spring	1989	176	164	0	340	89.28	88.20	88.76	571.76	561.79	566.95

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	354	351	0	705	3.54	3.55	3.55	1.29	1.32	1.30
Spring	1987	163	177	0	340	3.65	3.63	3.64	1.41	1.41	1.41
Spring	1988	171	171	0	342	3.64	3.53	3.59	1.41	1.30	1.35
Spring	1989	176	164	0	340	3.51	3.47	3.49	1.26	1.24	1.25

Appendix 3.2. Port samples collected from port cluster 2.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1985	244	242	0	486	90.44	90.22	90.33	599	599	599
Fall	1986	149	147	0	296	90.88	90.61	90.74	608	607	608
Fall	1987	250	199	0	449	90.63	90.06	90.38	603	596	600
Fall	1988	91	86	0	177	98.75	96.57	97.69	785	728	758
Fall	1991	128	129	0	257	93.59	94.18	93.89	666	678	672

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1985	244	242	0	486	3.56	3.55	3.56	1.32	1.32	1.32
Fall	1986	149	147	0	296	3.58	3.57	3.57	1.34	1.34	1.34
Fall	1987	250	199	0	449	3.57	3.55	3.56	1.33	1.32	1.32
Fall	1988	91	86	0	177	3.89	3.80	3.85	1.73	1.61	1.67
Fall	1991	128	129	0	257	3.68	3.71	3.70	1.47	1.49	1.48

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1991	135	168	0	303	93.15	93.46	93.32	651.53	663.14	657.96
Spring	1998	162	190	0	352	97.10	97.01	97.05	740.39	737.83	739.01

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1991	135	168	0	303	3.67	3.68	3.67	1.44	1.46	1.45
Spring	1998	162	190	0	352	3.82	3.82	3.82	1.63	1.63	1.63

Appendix 3.3. Port samples collected from port cluster 3.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	165	155	0	320	96.03	91.06	94	721	616	670
Fall	1992	417	412	0	829	90.46	89.28	90	600	582	591
Fall	1993	399	350	0	749	89.54	88.11	89	581	560	571
Fall	1994	152	124	0	276	89.40	88.60	89	578	569	574
Fall	1995	373	304	0	677	88.86	88.35	89	568	565	566
Fall	1996	485	324	0	809	88.31	87.43	88	557	548	553
Fall	1997	236	237	0	473	90.02	88.06	89	591	559	575
Fall	1998	199	139	0	338	88.36	86.67	88	558	534	548

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	165	155	0	320	3.78	3.58	3.69	1.59	1.36	1.48
Fall	1992	417	412	0	829	3.56	3.51	3.54	1.32	1.28	1.30
Fall	1993	399	350	0	749	3.53	3.47	3.50	1.28	1.24	1.26
Fall	1994	152	124	0	276	3.52	3.49	3.51	1.28	1.25	1.27
Fall	1995	373	304	0	677	3.50	3.48	3.49	1.25	1.24	1.25
Fall	1996	485	324	0	809	3.48	3.44	3.46	1.23	1.21	1.22
Fall	1997	236	237	0	473	3.54	3.47	3.51	1.30	1.23	1.27
Fall	1998	199	139	0	338	3.48	3.41	3.45	1.23	1.18	1.21

		Number				Length mm				Weight b			
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	B. Fem	Total	Males	Fem.	B. Fem	Total
Spring	1992	220	232	2	454	90.72	92.56	98.00	91.69	600.71	645.07	759.57	624.08
Spring	1993	148	144	0	292	97.50	98.22	0.00	97.85	749.85	764.35	0.00	757.00
Spring	1995	160	162	0	322	94.89	95.77	0.00	95.33	689.71	711.19	0.00	700.52
Spring	1996	150	129	0	279	93.19	93.33	0.00	93.25	652.36	660.60	0.00	656.17
Spring	1997	180	150	0	330	93.94	88.03	0.00	91.25	668.71	558.73	0.00	618.72

		Number				Length inches				Weight pounds			
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	B. Fem	Total	Males	Fem.	B. Fem	Total
Spring	1993	148	144	0	292	3.84	3.87	0.00	3.85	1.65	1.69	0.00	1.67
Spring	1995	160	162	0	322	3.74	3.77	0.00	3.75	1.52	1.57	0.00	1.54
Spring	1996	150	129	0	279	3.67	3.67	0.00	3.67	1.44	1.46	0.00	1.45
Spring	1997	180	150	0	330	3.70	3.47	0.00	3.59	1.47	1.23	0.00	1.36

Appendix 3.4. Port samples collected from port cluster 5.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	309	226	0	535	92.62	88.09	90.70	645	560	609
Fall	1985	545	490	0	1035	89.50	87.84	88.72	580	555	569
Fall	1986	426	403	0	829	90.50	88.36	89.46	600	565	583
Fall	1987	220	199	0	419	89.48	88.56	89.05	580	569	574
Fall	1988	231	217	0	448	89.46	88.96	89.22	579	576	578
Fall	1989	195	186	0	381	93.04	91.85	92.46	654	631	643
Fall	1990	206	196	0	402	88.50	88.04	88.28	561	559	560
Fall	1991	147	127	0	274	93.94	91.96	93.02	673	633	655
Fall	1993	199	162	0	361	91.34	89.87	90.68	618	593	607
Fall	1994	258	168	0	426	87.98	87.84	87.92	550	555	552

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	309	226	0	535	3.65	3.47	3.57	1.42	1.23	1.34
Fall	1985	545	490	0	1035	3.52	3.46	3.49	1.28	1.22	1.25
Fall	1986	426	403	0	829	3.56	3.48	3.52	1.32	1.25	1.29
Fall	1987	220	199	0	419	3.52	3.49	3.51	1.28	1.25	1.27
Fall	1988	231	217	0	448	3.52	3.50	3.51	1.28	1.27	1.27
Fall	1989	195	186	0	381	3.66	3.62	3.64	1.44	1.39	1.42
Fall	1990	206	196	0	402	3.48	3.47	3.48	1.24	1.23	1.23
Fall	1991	147	127	0	274	3.70	3.62	3.66	1.48	1.40	1.44
Fall	1993	199	162	0	361	3.60	3.54	3.57	1.36	1.31	1.34
Fall	1994	258	168	0	426	3.46	3.46	3.46	1.21	1.22	1.22

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	433	297	0	730	95.36	91.23	93.68	700.34	618.81	667.17
Spring	1987	199	134	0	333	91.14	86.85	89.41	609.17	537.64	580.38
Spring	1988	430	412	0	842	89.89	88.24	89.08	583.82	562.66	573.47
Spring	1989	180	203	0	383	94.28	92.43	93.30	676.16	642.54	658.34
Spring	1990	157	164	0	321	98.38	97.95	98.16	770.77	758.35	764.43
Spring	1991	172	155	0	327	90.39	87.28	88.92	593.95	545.34	570.91
Spring	1992	182	172	0	354	91.30	90.62	90.97	612.60	607.17	609.96
Spring	1993	148	154	0	302	94.47	92.12	93.27	680.33	636.39	657.92
Spring	1994	222	190	0	412	91.27	92.56	91.87	611.94	645.12	627.24

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	433	297	0	730	3.75	3.59	3.69	1.54	1.36	1.47
Spring	1987	199	134	0	333	3.59	3.42	3.52	1.34	1.19	1.28
Spring	1988	430	412	0	842	3.54	3.47	3.51	1.29	1.24	1.26
Spring	1989	180	203	0	383	3.71	3.64	3.67	1.49	1.42	1.45
Spring	1990	157	164	0	321	3.87	3.86	3.86	1.70	1.67	1.69
Spring	1991	172	155	0	327	3.56	3.44	3.50	1.31	1.20	1.26
Spring	1992	182	172	0	354	3.59	3.57	3.58	1.35	1.34	1.34
Spring	1993	148	154	0	302	3.72	3.63	3.67	1.50	1.40	1.45
Spring	1994	222	190	0	412	3.59	3.64	3.62	1.35	1.42	1.38

Appendix 3.5. Port samples collected from port cluster 6.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1992	210	182	0	392	89.39	87.71	88.61	578	553	566
Fall	1995	213	137	0	350	92.52	89.73	91.43	643	590	622
Fall	1996	171	164	0	335	91.74	88.91	90.35	626	575	601
Fall	1997	192	178	0	370	90.77	88.92	89.88	606	575	591
Fall	1998	204	202	0	406	88.75	87.50	88.13	565	549	557

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1992	210	182	0	392	3.52	3.45	3.49	1.27	1.22	1.25
Fall	1995	213	137	0	350	3.64	3.53	3.60	1.42	1.30	1.37
Fall	1996	171	164	0	335	3.61	3.50	3.56	1.38	1.27	1.33
Fall	1997	192	178	0	370	3.57	3.50	3.54	1.34	1.27	1.30
Fall	1998	204	202	0	406	3.49	3.44	3.47	1.25	1.21	1.23

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1995	185	184	0	369	93.72	91.96	92.84	663.90	633.10	648.54
Spring	1996	254	179	0	433	89.93	92.30	90.91	584.68	639.92	607.52
Spring	1997	149	164	0	313	100.67	98.45	99.51	827.48	769.62	797.16
Spring	1998	172	191	0	363	96.03	94.55	95.25	715.57	685.64	699.82
Spring	1999	179	213	0	392	93.72	92.37	92.98	663.81	641.30	651.58

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1995	185	184	0	369	3.69	3.62	3.66	1.46	1.40	1.43
Spring	1996	254	179	0	433	3.54	3.63	3.58	1.29	1.41	1.34
Spring	1997	149	164	0	313	3.96	3.88	3.92	1.82	1.70	1.76
Spring	1998	172	191	0	363	3.78	3.72	3.75	1.58	1.51	1.54
Spring	1999	179	213	0	392	3.69	3.64	3.66	1.46	1.41	1.44

Appendix 3.6. Port samples collected from port cluster 7.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	257	171	0	428	90.38	87.33	89.16	598	546	577

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	257	171	0	428	3.56	3.44	3.51	1.32	1.20	1.27

Appendix 3.7. Port samples collected from port cluster 8.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	231	174	0	405	88.81	89.29	89.02	567	582	573

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	231	174	0	405	3.50	3.52	3.50	1.25	1.28	1.26

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1997	148	159	0	307	95.77	92.68	94.17	709.65	647.44	677.43

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1997	148	159	0	307	3.77	3.65	3.71	1.56	1.43	1.49

Appendix 3.8. Port samples collected from port cluster 9.

Season	Start Year	Number				Length mm			Weight g		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1946	507	449	0	956	88.47	88.45	88.46	560	566	563
Fall	1949	496	386	0	882	92.05	92.02	92.04	633	634	633
Fall	1984	579	469	0	1048	90.07	88.27	89.27	592	563	579
Fall	1985	603	482	0	1085	88.60	88.13	88.39	562	561	562
Fall	1986	470	394	0	864	89.17	87.91	88.60	574	557	566
Fall	1987	476	358	0	834	89.89	87.62	88.92	588	551	572
Fall	1988	209	183	0	392	88.73	87.93	88.36	565	557	561
Fall	1989	234	246	0	480	88.19	87.68	87.93	555	553	553
Fall	1990	222	167	0	389	90.44	88.91	89.78	599	575	589
Fall	1991	238	155	0	393	89.94	89.76	89.87	589	591	590
Fall	1992	210	170	0	380	90.62	90.86	90.73	603	612	607
Fall	1993	196	139	0	335	93.46	94.37	93.84	663	682	671
Fall	1994	225	173	0	398	89.64	88.03	88.94	583	559	573
Fall	1995	197	194	0	391	90.11	89.07	89.60	593	578	585
Fall	1996	227	196	0	423	87.40	87.45	87.42	539	548	543
Fall	1997	302	228	0	530	90.94	89.89	90.49	609	593	602
Fall	1998	228	183	0	411	88.57	87.58	88.13	562	551	557

Season	Start Year	Number				Length inches			Weight pounds		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1946	507	449	0	956	3.48	3.48	3.48	1.23	1.25	1.24
Fall	1949	496	386	0	882	3.62	3.62	3.62	1.40	1.40	1.40
Fall	1984	579	469	0	1048	3.55	3.48	3.51	1.30	1.24	1.28
Fall	1985	603	482	0	1085	3.49	3.47	3.48	1.24	1.24	1.24
Fall	1986	470	394	0	864	3.51	3.46	3.49	1.26	1.23	1.25
Fall	1987	476	358	0	834	3.54	3.45	3.50	1.30	1.22	1.26
Fall	1988	209	183	0	392	3.49	3.46	3.48	1.25	1.23	1.24
Fall	1989	234	246	0	480	3.47	3.45	3.46	1.22	1.22	1.22
Fall	1990	222	167	0	389	3.56	3.50	3.53	1.32	1.27	1.30
Fall	1991	238	155	0	393	3.54	3.53	3.54	1.30	1.30	1.30
Fall	1992	210	170	0	380	3.57	3.58	3.57	1.33	1.35	1.34
Fall	1993	196	139	0	335	3.68	3.72	3.69	1.46	1.50	1.48
Fall	1994	225	173	0	398	3.53	3.47	3.50	1.29	1.23	1.26
Fall	1995	197	194	0	391	3.55	3.51	3.53	1.31	1.27	1.29
Fall	1996	227	196	0	423	3.44	3.44	3.44	1.19	1.21	1.20
Fall	1997	302	228	0	530	3.58	3.54	3.56	1.34	1.31	1.33
Fall	1998	228	183	0	411	3.49	3.45	3.47	1.24	1.21	1.23

Appendix 3.8. Port samples collected from port cluster 9 (continued)

Season	Start Year	Number				Length mm			Weight g		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1946	409	458	0	867	89.00	88.05	88.50	566.34	559.20	562.56
Spring	1986	492	467	0	959	88.94	88.28	88.62	565.14	563.35	564.27
Spring	1987	495	417	0	912	90.20	88.69	89.51	590.20	570.87	581.36
Spring	1988	337	360	0	697	91.97	91.65	91.81	626.57	627.13	626.86
Spring	1989	199	173	0	372	90.62	90.47	90.55	598.68	604.33	601.31
Spring	1990	203	182	0	385	95.85	93.31	94.65	711.41	660.08	687.15
Spring	1991	156	174	0	330	94.42	92.30	93.30	679.23	639.87	658.47
Spring	1992	164	176	0	340	93.96	91.95	92.92	669.11	633.06	650.45
Spring	1993	158	159	0	317	95.49	92.22	93.85	703.36	638.31	670.73
Spring	1994	205	188	0	393	93.36	93.48	93.42	656.02	663.66	659.67
Spring	1995	194	187	0	381	95.13	91.61	93.40	695.24	626.29	661.40
Spring	1996	207	213	0	420	92.33	90.91	91.61	634.04	612.63	623.18
Spring	1997	201	195	0	396	94.44	91.99	93.23	679.81	633.75	657.13
Spring	1998	209	176	0	385	94.80	93.06	94.01	687.73	655.13	672.83

Season	Start Year	Number				Length inches			Weight pounds		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1946	409	458	0	867	3.50	3.47	3.48	1.25	1.23	1.24
Spring	1986	492	467	0	959	3.50	3.48	3.49	1.25	1.24	1.24
Spring	1987	495	417	0	912	3.55	3.49	3.52	1.30	1.26	1.28
Spring	1988	337	360	0	697	3.62	3.61	3.61	1.38	1.38	1.38
Spring	1989	199	173	0	372	3.57	3.56	3.57	1.32	1.33	1.33
Spring	1990	203	182	0	385	3.77	3.67	3.73	1.57	1.46	1.51
Spring	1991	156	174	0	330	3.72	3.63	3.67	1.50	1.41	1.45
Spring	1992	164	176	0	340	3.70	3.62	3.66	1.48	1.40	1.43
Spring	1993	158	159	0	317	3.76	3.63	3.69	1.55	1.41	1.48
Spring	1994	205	188	0	393	3.68	3.68	3.68	1.45	1.46	1.45
Spring	1995	194	187	0	381	3.75	3.61	3.68	1.53	1.38	1.46
Spring	1996	207	213	0	420	3.63	3.58	3.61	1.40	1.35	1.37
Spring	1997	201	195	0	396	3.72	3.62	3.67	1.50	1.40	1.45
Spring	1998	209	176	0	385	3.73	3.66	3.70	1.52	1.44	1.48

Appendix 3.9. Port samples collected from port cluster 10.

Season	Start Year	Number				Length mm			Weight g		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	440	278	0	718	88.42	86.47	87.66	559	531	548
Fall	1998	228	230	0	458	88.88	87.34	88.11	568	546	557

Season	Start Year	Number				Length inches			Weight pounds		
		Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1997	440	278	0	718	3.48	3.40	3.45	1.23	1.17	1.21
Fall	1998	228	230	0	458	3.50	3.44	3.47	1.25	1.20	1.23

Appendix 3.9. Port samples collected from port cluster 10 (continued)

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1997	189	201	0	390	94.95	91.22	93.03	691.04	618.68	653.75
Spring	1998	219	200	0	419	93.10	90.31	91.76	650.41	601.11	626.87

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1997	189	201	0	390	3.74	3.59	3.66	1.52	1.36	1.44
Spring	1998	219	200	0	419	3.67	3.56	3.61	1.43	1.33	1.38

Appendix 3.10. Port samples collected from port cluster 13.

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	420	276	0	696	92.23	88.95	90.93	637	576	612
Fall	1985	282	243	0	525	90.30	87.32	88.92	596	546	573
Fall	1986	422	383	0	805	91.62	90.09	90.89	623	597	611
Fall	1987	440	353	0	793	92.36	88.74	90.75	639	572	609
Fall	1988	220	182	0	402	89.03	87.38	88.28	571	547	560
Fall	1989	219	219	0	438	88.79	88.10	88.44	566	560	563
Fall	1990	203	194	0	397	89.26	88.98	89.12	575	576	576
Fall	1991	196	168	0	364	89.40	88.73	89.09	578	572	575
Fall	1992	220	211	0	431	89.19	89.05	89.12	574	578	576
Fall	1994	213	187	0	400	90.23	88.47	89.41	595	567	582
Fall	1995	462	311	0	773	89.36	87.66	88.68	577	552	567
Fall	1996	217	220	0	437	89.69	87.05	88.36	584	541	562
Fall	1997	371	291	0	662	90.71	88.50	89.74	605	567	588
Fall	1998	229	177	0	406	89.52	87.81	88.77	581	555	569

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Fall	1984	420	276	0	696	3.63	3.50	3.58	1.40	1.27	1.35
Fall	1985	282	243	0	525	3.56	3.44	3.50	1.32	1.20	1.26
Fall	1986	422	383	0	805	3.61	3.55	3.58	1.37	1.32	1.35
Fall	1987	440	353	0	793	3.64	3.49	3.57	1.41	1.26	1.34
Fall	1988	220	182	0	402	3.51	3.44	3.48	1.26	1.21	1.23
Fall	1989	219	219	0	438	3.50	3.47	3.48	1.25	1.23	1.24
Fall	1990	203	194	0	397	3.51	3.50	3.51	1.27	1.27	1.27
Fall	1991	196	168	0	364	3.52	3.49	3.51	1.27	1.26	1.27
Fall	1992	220	211	0	431	3.51	3.51	3.51	1.27	1.27	1.27
Fall	1994	213	187	0	400	3.55	3.48	3.52	1.31	1.25	1.28
Fall	1995	462	311	0	773	3.52	3.45	3.49	1.27	1.22	1.25
Fall	1996	217	220	0	437	3.53	3.43	3.48	1.29	1.19	1.24
Fall	1997	371	291	0	662	3.57	3.48	3.53	1.33	1.25	1.30
Fall	1998	229	177	0	406	3.52	3.46	3.50	1.28	1.22	1.26

Appendix 3.10. Port samples collected from port cluster 13 (continued)

		Number				Length mm			Weight g		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	320	416	0	736	93.47	92.17	92.74	658.59	637.33	646.57
Spring	1987	393	413	0	806	90.19	89.02	89.59	589.99	577.04	583.35
Spring	1988	348	270	0	618	90.80	88.87	89.95	602.21	574.12	589.94
Spring	1989	172	163	0	335	94.62	90.33	92.53	683.79	601.49	643.75
Spring	1990	194	184	0	378	96.11	94.94	95.54	717.39	693.67	705.84
Spring	1991	194	188	0	382	91.38	91.98	91.68	614.24	633.54	623.74
Spring	1992	181	175	0	356	93.14	92.20	92.68	651.31	637.91	644.72
Spring	1993	185	185	0	370	91.80	92.23	92.01	622.94	638.44	630.69
Spring	1994	212	132	0	344	93.70	90.83	92.60	663.55	611.23	643.47
Spring	1995	179	156	0	335	95.20	92.27	93.84	696.75	639.28	669.99
Spring	1996	162	163	0	325	93.73	91.80	92.76	664.10	630.09	647.05
Spring	1997	185	183	0	368	96.81	94.05	95.44	733.65	675.31	704.64
Spring	1998	187	170	0	357	98.16	93.56	95.97	765.59	665.18	717.78
Spring	1999	183	193	0	376	96.55	92.52	94.48	727.50	644.23	684.76

		Number				Length inches			Weight pounds		
Season	Start Year	Males	Fem.	B. Fem	Total	Males	Fem.	Total	Males	Fem.	Total
Spring	1986	320	416	0	736	3.68	3.63	3.65	1.45	1.41	1.43
Spring	1987	393	413	0	806	3.55	3.50	3.53	1.30	1.27	1.29
Spring	1988	348	270	0	618	3.57	3.50	3.54	1.33	1.27	1.30
Spring	1989	172	163	0	335	3.73	3.56	3.64	1.51	1.33	1.42
Spring	1990	194	184	0	378	3.78	3.74	3.76	1.58	1.53	1.56
Spring	1991	194	188	0	382	3.60	3.62	3.61	1.35	1.40	1.38
Spring	1992	181	175	0	356	3.67	3.63	3.65	1.44	1.41	1.42
Spring	1993	185	185	0	370	3.61	3.63	3.62	1.37	1.41	1.39
Spring	1994	212	132	0	344	3.69	3.58	3.65	1.46	1.35	1.42
Spring	1995	179	156	0	335	3.75	3.63	3.69	1.54	1.41	1.48
Spring	1996	162	163	0	325	3.69	3.61	3.65	1.46	1.39	1.43
Spring	1997	185	183	0	368	3.81	3.70	3.76	1.62	1.49	1.55
Spring	1998	187	170	0	357	3.86	3.68	3.78	1.69	1.47	1.58
Spring	1999	183	193	0	376	3.80	3.64	3.72	1.60	1.42	1.51